

SIXTY-NINTH YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CIX
NUMBER 4.

NEW YORK, JULY 26, 1913

PRICE 10 CENTS
\$3.00 A YEAR



If the real capacity of power-propelled machinery is to be gained in city transportation, foot and vehicular traffic must be segregated. Each type of transport will then be free to develop itself along its own lines.

THE ELEVATED SIDEWALK: HOW IT WILL SOLVE CITY TRANSPORTATION PROBLEMS.—[See page 67.]

SCIENTIFIC AMERICAN

Founded 1845

NEW YORK, SATURDAY, JULY 26, 1913

Published by Munn & Co., Incorporated. Charles Allen Munn President
Frederick Converse Beach, Secretary and Treasurer
all at 361 Broadway, New York

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Subscription one year \$5.00
Postage prepaid in United States and possessions,
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Subscriptions for Foreign Countries, one year, postage prepaid, 4.50
Subscriptions for Canada, one year, postage prepaid, 3.75

The Scientific American Publications

Scientific American (established 1845) per year, \$5.00
Scientific American Supplement (established 1876) 5.00
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Munn & Co., Inc., 361 Broadway, New York

The Editor is always glad to receive for examination illustrated
articles on subjects of timely interest. If the photographs are sharp,
the articles short, and the facts authentic, the contributions will
receive special attention. Accepted articles will be paid for at
regular space rates.

*The purpose of this journal is to record accurately,
simply, and interestingly, the world's progress in scientific
knowledge and industrial achievement.*

Should the Government Manufacture Its Own Armor Plate?

ALTHOUGH there may be some division of opinion as to the wisdom of certain of the policies of the present indefatigable Secretary of the Navy, no one, surely, will deny that Mr. Daniels, during the few months he has been in office, has given every evidence of a sincere purpose to promote the interest of the Navy by the use of every means at his command; and if that conviction should become firmly settled in the minds of the people of this country and their representatives in Congress, Mr. Daniels will be in a fair way to secure many of the betterments of conditions at which he is aiming. One of the most important innovations which he has suggested is that of the construction by the Federal Government of an armor-making plant of sufficient capacity to enable the Government to supply fifty per cent of the total amount of armor plate required annually for the construction of warships.

There was a time when the SCIENTIFIC AMERICAN would have strongly opposed any such suggestion, on the ground that previous experience had shown work of this character to be more tedious and more costly than similar work when done by the private contractor. But with the lapse of time conditions have changed, and the results obtained in Government manufacturing plants, particularly during the past decade, have shown that a superior product can be turned out of Government shops and yards, which, if the labor restrictions are considered, compares favorably with the cost of contract work. Results obtained in the construction of the battleship "New York" prove that the above broad statement is true, even in the case of warships that are built at navy yards. The "New York" was built within the limits of the appropriation, and the navy yard bid came within a negligible amount of the lowest bid put in by the private yards. In this connection it should be noted that the work on such ships is of the very highest character, fully equal to similar work in private yards; and there is always the great advantage to the navy yards to maintain a large and thoroughly-drilled force, which understands the peculiar work of the yards, and is always available should a sudden emergency of war arise.

The wisdom of the construction of a Federal armor plant will be settled if a satisfactory answer can be given to two questions. First, could a Government plant, when built, organized and in thorough working condition, turn out a product equal to that now delivered by the private maker? Second, could it deliver this product at the same or a less price than is now paid by the Government? In answer to the first question it is sufficient, surely, to point to the exceedingly fine naval gun shop at Washington, where a large part of the armament for our warships is built, the output of which is believed to be as fine as that delivered from any gun shop, Government or private, the world over, or to the excellent product of our naval powder factory. It is stated by the Bureau of Ordnance of the Navy—we believe with very good reason—that the Government output of guns is equal in quality to that of any gun makers, and that our powder, so far as comparisons can be made, is decidedly superior in all-round efficiency to any other.

As to the question of cost, the Secretary of the Navy

has informed the Senate that a plant capable of turning out ten thousand tons of armor plate a year, or about half of the armor needed on a two-battleship programme, would be \$8,456,000, and that when this plant was in running order, armor could be delivered at a cost of \$314 a ton. The price now paid is \$454; so that if the Chief of the Bureau of Ordnance who supplied the figures is correct, and there is every reason to believe that he is, a saving of \$140 a ton would be effected over the present price. This would represent a saving to the Government on ten thousand tons of \$1,400,000 annually. After deducting four per cent interest on the investment in the plant, there would still remain a net saving to the Government per year of over \$1,000,000.

A review of the facts, then, seems to justify the Senate and Congress in voting the necessary appropriation for the construction of such a plant.

Of Nation-wide Importance

WE offer no apology for referring editorially in two successive issues of this journal to the question of oil fuel. Last week we indicated some of the serious contingencies which might arise if the Navy made a sweeping change from coal to oil fuel. The question is of national importance; for anything that vitally affects the Navy is of vital importance to the peace and permanence of the nation.

In this age of rapid development it not infrequently happens that the progress of invention, with a positively startling stride, will give to one of the natural products a position of commanding importance never dreamed of until the fruitful inventor opened up new and wider fields of usefulness. The latest, if not the most conspicuous instance of such a development is to be found in the case of petroleum. Formerly valued almost exclusively as a source of light, its field of usefulness has been rapidly widened by the advent of the internal combustion engine, the automobile, the motorboat, the auxiliary cruiser, and the aeroplane and the dirigible. Concurrently with this rapid widening out of its field, there was started and carried to a successful demonstration that elaborate series of investigations and inventions which have given us the perfected oil burner and the successful use of oil as a fuel for steam generation.

The result of this widespread extension of the use of petroleum has been to give to this natural product a position of commanding importance, both to the nation and to the individual. We pointed out last week how seriously our national interests were or might be affected by the availability and cost of this fuel, and we wish now to emphasize the fact that the progress of invention has made the same questions of availability and cost of very intimate importance to the health and pleasure of the individual citizen.

By way of emphasis, it is sufficient to instance the automobile and its humbler brother, the motorcycle. The past three or four years, thanks mainly to the skill of the automobile and motorcycle manufacturer, have seen a wide extension of the previously comparatively narrow circle which included those who were able to bear the cost of purchase and ownership. Concurrently, however, there has been an increase in the cost of the fuel, which has been so steady and has assumed such proportions as to discourage many people of more limited means who had hoped to become owners of their own machines.

In view of the above facts, the petroleum user will note with much gratification that the United States Department of Agriculture has called a meeting in Pittsburgh, on August 1st, to which a score of different societies have been invited to send delegates, and that the gathering will devote its attention mainly to the question of petroleum and its various by-products. The movement is being promoted by Irving C. Allen, the expert on petroleum of the Bureau of Mines, who has given the following statement on the object of his Bureau:

"A study of petroleum and its products has never been thoroughly or comprehensively made within the United States.

"Since each year crude petroleum and gases are produced in the United States, having a value in excess of \$200,000,000, it is most important that a thorough study of these materials be undertaken.

"This study should include the origin, geology, statistics, drilling methods, transportation and uses of crude petroleum, and a critical and scientific description of petroleum products of all kinds, including bitumen and gases."

The proposed technical body will work in co-operation with the International Petroleum Commission, organized in Paris as far back as the year 1900. This action on the part of the Bureau of Mines should receive the whole-hearted co-operation of everyone who is interested in the petroleum question, and particularly of the powerful manufacturing corporations which directly or indirectly are dependent upon the petroleum industry.

The Grade-crossing Scandal

WHETHER familiarity breeds contempt of danger or not, it certainly breeds a callous indifference to the deaths and injuries which result from some of the needless dangers to which the public is exposed. Unhappily, no one of us need go very far afield to find clear proof of this statement. Of the many perils which take their large annual toll of human life, there are certainly few which are more broadcast and certainly few that are more easily preventable than the grade-crossings of railroads. Half a century or so ago, when capital was scarce and population more thinly spread over the land, it would have been placing an intolerable burden upon the railroads to demand there should be no crossings of public highways at grade level. Practically all pioneer railroads, even where they passed through the cities, were built at street or highway level. The necessities of the case made such construction compulsory. But with the times conditions have changed. The better managed (or shall we say the more humanitarian?) of our railroads have of their own volition abolished the grade crossings, or are now engaged in doing so. From motives of convenience and cost of operation alone, the average railroad manager would gladly abolish every grade crossing from the system. Looked at from his standpoint, grade crossings are a cause of delay and expense, to say nothing of the mental strain they entail upon the engineman and the perpetual anxiety to the management; while leaving humanitarian considerations out of the question, there are the legal costs of compensation in case of accident, and the always-dreaded notoriety and unpopularity which follow a grade-crossing accident.

So far as the railroads are concerned, undoubtedly the chief obstacle to the removal of grade crossings has been the expense of the reconstruction; but of late years it has come to be recognized that the cost of elimination should be considered as a joint obligation on the railroad, the State, and the municipality in which the crossing exists. It is under such an arrangement that Chairman McCall of the Public Service Commission has made an appeal, which we trust will receive the favorable consideration of Governor Sulzer, asking that the State appropriate \$1,000,000 as its share toward eliminating railroad grade-crossings in the thickly-settled suburbs of New York city.

The appeal of the Commission is accompanied by an illuminating report upon present conditions, in which it is stated that on the Long Island Railroad system alone, there are 697 crossings at grade, of which less than half, we learn to our astonishment, are protected by gates, flagmen or even alarm bells. In greater New York alone there are 477 grade-crossings which are designated as dangerous. It is noted that in Brooklyn between Norwood Avenue and Jamaica there are from 210 to 322 train movements, daily, over the crossings at each street, and that at one of these an average of 423 school children cross the tracks four times each day. Again, an investigation of Railroad Avenue in Brooklyn showed that in an hour and a half 453 persons went over a crossing, over which 11 local trains and 25 express trains passed during the same period. In the four years, 1908 to 1912, 100 persons were killed at crossings within the limits of New York, and 150 were injured.

The distribution of the cost of abolishing grade-crossings in this city is that one fourth is borne by the State, one fourth by the municipality, and one half by the railroad companies concerned. The companies express themselves as ready to proceed, and the city has also granted its share. The question of the removal of grade-crossings, and the abolition of conditions that are a disgrace to our civilization, is thus squarely in the hands of the Chief Executive, to whom the railroads and the citizens of New York are looking for immediate and decisive action.

The Tenth International Geographical Congress

AFTER being postponed for a year and a half, the tenth international geographical congress, which met in Rome this spring, was occupied especially with discussing the international map of the world and polar exploration. Under the former head it was announced that nine countries (including the United States) had undertaken the preparation of sheets of the international map in accordance with the programme drawn up at London in 1900. It is now proposed to hold another international conference, probably in Paris, to settle several details of the undertaking. The International Polar Commission held a meeting in conjunction with that of the congress, and many eminent polar explorers and authorities were in attendance, including Peary, Cagni, Bruce, Norden-skjöld, Lecomte, and Stefánsson. Great interest was shown in the Canadian Arctic expedition, under Stefánsson. A proposal to add Spanish to the official languages of the congresses led to a lively discussion, terminated only by the threat of the Russians to insist upon their own language if Spanish were introduced.

Engineering

Battleships Versus Buildings.—The Secretary of the Navy is of the opinion that by the disposal of buildings of doubtful value, and by conservative appropriation of moneys for new buildings at navy yards, it will be possible to assist materially his efforts to persuade Congress to live up to the two-battleships-a-year programme which is the minimum necessary to keep our navy up to a reasonable strength for its duties.

The Drydock a Dutch Invention.—A correspondent in Holland draws our attention to the fact that the construction in that country of a floating dock of 14,000 tons, for Soerabaya harbor in the Dutch Indies, should remind us that the floating drydock is a Dutch invention, and that many floating docks of this type are built on Dutch ways and towed to their destination. Drydock towing is a specialty, and many foreign-built docks are towed to their destination by Dutch tugs.

Suez Canal Traffic.—During the year 1912, 20,275,120 tons of shipping passed through the Suez Canal, an increase of nearly 2,000,000 tons over the year of 1911. The total receipts of \$27,300,000 were the greatest in the history of the canal. During the year 5,373 ships passed through the canal, and of these 3,335 flew the British flag. Such figures as these give ground for the hope that the Panama Canal may become self-supporting and even profitable sooner than some of our statisticians have predicted.

Our Latest Battleship.—No. 39, the latest battleship to be built for the U. S. Navy, is about to be laid down at the New York navy yard, Brooklyn. Sister to the "Pennsylvania," she will be the largest and most powerful battleship under construction. The particulars are: Length, 608 feet; beam, 97 feet; displacement on trial, 31,400 tons. She will have a 14-inch belt, and 18 inches on the turrets, in which will be carried twelve 14-inch, 45-caliber guns. The complement will number 1,100 officers and men, and the ship will cost, complete, \$16,000,000.

The Engineer-Architect in Ancient Rome.—It was largely their development of the dome and the arched roof in masonry, that enabled the Romans to build on a scale of daring and magnificence which has not been surpassed in our modern age of steel. Recent excavations in Nero's palace have revealed five subterranean vaulted rooms in the proximity of the dining-room, which were built as fish tanks and used to keep fish alive for the use of the imperial table. The vault and the dome or round roof of the Romans served the purpose of the modern I-beam and latticed roof girder as used by the present-day architect and engineer.

Progress in Electrifying Steam Railroads.—If we bear in mind the many difficult problems and the great cost involved in changing from steam to electric operation on railroads, it must be admitted that this country has made great strides in this direction. A recent estimate places the total number of miles of single track that has been changed from steam to electric operation at about 1,600 miles, and the same authority finds that approximately 1,500 miles of single railroad track will probably, during the next few years, be subjected to the same change. Too much credit cannot be given to the New York Central and the New Haven railroads for the courageous pioneer work which they undertook in this direction.

Completion of a Great Hydro-Electric Plant.—With the completion by the Mexican Light and Power Company of its light and power plants in Mexico, another great hydro-electric work is about to be put in service. The main power plants have an aggregate capacity of 127,500 horse-power and auxiliary plants at four separate points bring up the total horse-power to about 150,000. The work includes large storage reservoirs in the mountains, tunnels through the intervening ridges of rock and transmission lines. The aggregate storage capacity is sufficient to keep the plants in operation for six months without any rainfall. The current will furnish light and power for the city of Mexico and its capacity is sufficient also to run the trolley systems in the city and the whole Federal district.

Steel Ties in Europe.—During a recent visit to Europe, the writer was struck with the fact that the steel tie, which has made very little headway in the United States, is extensively used abroad, and particularly in Germany, where only two years ago the Prussian State Railways alone purchased over 150,000 tons of ties of this character. We noted on the fine stretch of road between Berlin and Hamburg, that the steel-tie track was of most excellent quality, both as regards the surface and alignment; and we were particularly surprised to find that, contrary to the general impression, the track was not noisy, but was as a matter of fact more silent than some stretches of good track over which we have ridden which were laid on wooden ties. It is fair to state, however, that the German locomotives and cars are much lighter than those in the United States.

Electricity

Transatlantic Wireless Communication from Sayville, Long Island, to Berlin, Germany, has just been established by the German Telefunken System. Messages sent from Sayville on July 12th were clearly received at the Nauen station near Berlin, spanning a distance of 4,000 miles.

Electrolytic Protection Against Boiler Corrosion.—A method of preventing boiler corrosion has recently been developed in which iron anodes are introduced into the boiler, and currents are passed from them to the metal parts of the boiler. Iron is used for the anodes because it is cheap and because the salts of iron are found to be harmless. The current used may be supplied by a small generator of six to ten volts, with from two to four amperes, per thousand square feet of heating surface. The boiler proper forms the negative pole and consequently hydrogen is given off, due to the electrolytic action. This prevents any scale or dirt from forming on the tubes or shell and loosens any adhering foreign matter that may have lodged there prior to the application of the current.

Electric Power Developments in Russia.—It is reported that the Russian government has lately granted the rights to English interests for the construction of electric stations, using the power of Terek River and Lake Goktcha, together with long power lines running to distant points. First, a temporary plant will be erected on the Terek River near Gvilete village, which is to furnish 20,000 horse-power, then a permanent turbine station on the same stream near the railroad station of Lars, so as to secure as much as 50,000 horse-power. Current from these plants will be taken over power lines to Tiflis and Vladikavkas. One or two hydraulic plants will also be erected on Lake Goktcha near the Tarscha and Akstafa rivers, and these are expected to provide at least 40,000 horse-power. Current will be used in the city of Tiflis. It will be seen that the present project is quite an extensive one.

Device for Detecting Fire Damp.—An electric device which is said to give very good results in Australian mines for detecting fire damp and ringing an alarm bell, is based on the use of a porous vessel into which the gas penetrates. The apparatus has a U-tube containing mercury in the lower part. On one side is a platinum wire which always remains in contact with the mercury, while the second branch of the tube has a platinum point lying above the level of the mercury. Current from the battery and bell comes to the two platinum points. On the first branch of the tube is placed a closed, porous vessel, and if there is fire damp at this spot, the gas penetrates the porous cup and acts to increase the pressure on that side, thus driving down the mercury and causing it to rise in the other branch so as to complete the battery circuit and ring the bell. The contact point is adjusted so that a sufficient proportion of fire damp in the air causes the mercury to rise to the proper height for making the contact.

Goldschmidt Transatlantic Wireless Experiments.—The daily papers recently contained reports of wireless telegraph communications between Neustadt, near Hanover, Germany, and Tuckerton, New Jersey, established under the Goldschmidt system. The reports have not been absolutely authenticated. One of the principal features of the system is a high frequency generator invented by Dr. R. Goldschmidt, which will give 150 kilowatts at a frequency of fifty or sixty thousand oscillations per second. The machine consists of a rotor and stator arranged to give 15,000 oscillations at 15,000 revolutions per minute. This high frequency current is returned to the stator, producing a rotating field opposite in direction to the rotation of the rotor, thereby producing a frequency of 30,000. This in turn is sent back through the stator, so that it yields 45,000. In this way the frequency may be stepped up to 50,000 oscillations. At the receiving station a fine musical note is heard which is readily distinguishable from other signals. The Goldschmidt machine is known as the "singing wheel."

An Electrical Research Laboratory and Bureau is to be established at the Massachusetts Institute of Technology. In connection with the laboratory there is to be a new electrical library, for which an endowment of over \$110,000 is assured. Dr. Harold Pender will be the director of the laboratory with H. F. Thomson as his secretary and assistant. The new laboratory has received an endowment of \$10,000 a year for five years from the American Telephone and Telegraph Company, and \$5,000 a year for five years from an anonymous donor, the latter to be used in determining the distance to which a street car passenger can, with reasonable profit, be carried for a five-cent fare. The laboratory has also received a gift of \$2,000 from the Boston & Maine and the New York, New Haven & Hartford Railroad, for the study of freight handling at terminals. About a year ago the American Telephone and Telegraph Company gave the Institute the Dering electrical library of 30,000 titles valued at \$100,000. To maintain the library the company has assured to the Institute the sum of \$5,000 a year.

Science

Aerological Observations in Brazil.—Prof. Berson of the Lindenberg Observatory recently made a journey to northeastern Brazil to arrange for carrying out a series of upper-air observations in that region, which lies in the zone of the southeast trade-winds.

The Natural History Collections of Capt. Scott's Expedition are to be turned over to the Natural History Museum, South Kensington (i. e., the natural history branch of the British Museum). The trustees of the British Museum have agreed to undertake the publication of the natural history results of the expedition.

The German Antarctic Expedition under Lieut. Filchner will not resume operations next season, as had been intended. The *Geographische Zeitschrift* announces that the expedition's ship, the "Deutschland," is about to return to Germany, marking the end of an enterprise which aroused much patriotic enthusiasm when it was undertaken (before the attainment of the pole by Amundsen and Scott), but which has been somewhat disappointing in its results.

The Meteorological Service of Russia finds itself in the position, rare in the experience of European scientific institutions, of having ample funds for its present needs and future development, thanks to a very liberal increase in its budget recently authorized by the government. The buildings of the Central Physical Observatory, the headquarters of the service in St. Petersburg, are to be enlarged; a meteorological observatory is to be established immediately at Vladivostok, under which will be organized a network of new Siberian stations; a new aerological observatory is to be erected this year near Pavlovsk, and in 1915 aerological sections will be added to the observatories at Tiflis, Ekaterinburg and Irkutsk.

Aeronautical Meteorology in France.—The president of the Meteorological Society of France, Lieut.-Col. Rénard, who is more widely known as an aeronaut than as a meteorologist, has addressed a circular letter to the principal meteorological and aeronautical societies and the official meteorological institutes inviting them to send delegates to a conference on the subject of aeronautical meteorology; its objects being to facilitate the utilization by aeronauts of the daily weather forecasts and other practical work of meteorologists, and, on the other hand, to encourage aeronauts to make scientific observations during their ascents for the benefit of meteorology.

Papain, the most important chemical constituent of the papaya, is the subject of a recent report by the American consul at Colombo, Ceylon. Probably few of the travelers in tropical countries who enjoy the melon-like papaya realize that this fruit contains one of the most valuable digestives known to medicine, though the natives of the Orient, especially in southern India and Ceylon, use the fruit almost universally to prevent dyspepsia. There are several varieties of *Carica papaya*, and the papain obtained from the different kinds varies accordingly, the best being that derived from the male trees of a hybrid variety occurring in Ceylon. The digestive and disintegrating properties of papain are shown by the fact that the native cooks in Ceylon wrap tough meat in fresh papaya leaves to make it tender, or apply a small quantity of the milky juice of the plant to the surface of the meat, or put a piece of the green fruit into the raw curry when the meat will not boil soft. Papain is said to be capable of digesting ten to twelve times its weight of egg albumen at the temperature of the human body.

The Sounds of Earthquakes, as illustrated in the seismological records of Great Britain, are the subject of an exhaustive memoir by Charles Davison in *Beiträge zur Geophysik*. These sounds are described as variations of heavy rumbling noise, so low in pitch as almost to be more felt than heard (in many cases inaudible to persons who are deaf to very low tones), and belonging to one or another of the following types: The passing of wagons, thunder, wind, the fall of a load of stones, the fall of a heavy body, an explosion, or some other miscellaneous sound. The relations of the sound area to the area over which the shock is felt, in place and time, are particularly interesting and significant. In strong earthquakes the sound area occupies a central region (on an average two thirds) of the disturbed region; in moderate earthquakes the two areas are approximately of the same magnitude; while in many slight earthquakes the sound area is larger than the disturbed area. As a rule the beginning of the sound precedes the shock, and the end of the sound follows the end of the shock. Assuming earthquakes to be caused generally by the slips which constitute the growth of faults, the author points out that the seismic focus in its simplest form must consist of a central region, from which the shock vibrations chiefly come, surrounded, at any rate above and laterally, by a marginal region, from which the sound vibrations chiefly come.

The Salvage and Repair of the Steamship "Royal George"

Converting a Sunken Ship Into a Bubble of Air

By R. G. Skerrett

THE refloating and the repair of the stranded steamship "Royal George" gives us a strikingly novel example of what compressed air has made possible when skilfully adapted to the needs of a case. This particular exploit, too, shows the sand-hog in a new field of activity—not the tunnel and caisson work with which we have some familiarity.

While outward bound from Montreal for Bristol, the liner "Royal George," during a dense fog, went ashore at high tide about nine miles below Quebec. That was upon the 6th of last November. The ship is a craft of 14,000 tons, had cargo and passengers aboard, and was upon her last homeward trip before winter closed the St. Lawrence to navigation. At once, local salvage facilities were hastened to the scene and every ordinary effort promptly directed toward the vessel's refloating.

After nearly two weeks of fruitless striving, it was recognized that the usual salvage procedure and apparatus would not answer, and Mr. W. W. Wotherspoon was summoned from a nearby wreck upon which he was then engaged—the stranded collier "Gladstone." Upon the latter he was using compressed air, and the underwriters decided to try the same method upon the "Royal George," authorizing Mr. Wotherspoon to go ahead. Accordingly, all of the pumps were removed and the hatches to the damaged compartments sealed by air-tight plates. Air-locks were secured to the circular passageway in these metallic hatch covers, and connections also made by pipe between the air compressors and the injured holds. In three days this work was completed and the compressors started at 10 P. M. of November 22nd; fifteen minutes later the forward cargo space was dry! It is interesting to know how this was accomplished.

It was necessary to provide against the pressure of a head of water of twenty-three feet that the compressed air was to offset, and the deck overlying the compartment was not equal to a bursting stress of this magnitude. Worse still, that deck did not rest upon a solid steel deck, and there was the certain risk of blowing out the calking between the planks, which would mean failure. To meet the situation, Mr. Wotherspoon poured hot pitch into all the deck seams, covered the deck with a number of layers of tar paper, and over these placed a veneer of spruce flooring. Then he braced the pressure deck, let us say, by shores reaching to the deck above, and in this fashion distributed the stress to be absorbed when the holds should be filled with compressed air. In brief, he turned the flooded cargo spaces into caissons, and then all was in readiness for the expulsion of the invading water.

An internal examination of the injured holds showed that nearly forty per cent of the ship's bottom was damaged, but it also demonstrated that the air-salvage apparatus was equal to the demands to be placed upon it. The next afternoon, two hours before high tide, the water was blown out from the flooded compartments and the vessel floated clear. But this was not the solution of the entire problem.

The nearest dry-dock was at Montreal, 140 miles away, and the river's closed season was drawing near. But, besides this danger of having the ship held for months, there was the prospect of heavy dock charges independently of the cost of repairs. There was every reason for haste and economy within reason, but the question was "How could the 'Royal George' be made ready for sea otherwise?" Mr. Wotherspoon answered this in a unique and a thoroughly satisfactory manner. This is the best part of the story.

The ship was anchored out in deep water, and down into the damaged spaces the sand-hogs were sent

through the air-locks—the compartments being held substantially drained by reason of the compressed air within them. Beginning at the uppermost point of the wounds in the ship's steel skin, the sand-hogs roughly

sible, but there was a way to effect the desired repairs. From within, flexible templates of wood were made of each needed patch, and upon these were marked the places for bolt holes—the same positions being indicated upon the inner surface of the vessel's plating. The templates were sent up through the air-locks and guided the steel workers in forming the steel patches and in boring the threaded bolt holes. Into these holes tap bolts were screwed. In the meantime, slightly larger holes were drilled around each wound and made tight with wooden plugs from within. A weighted ladder was swung under the ship and directly beneath the rents to be mended. A diver was sent down who took his place upon this submerged platform for the purpose of co-operating with the sand-hogs within the ship.

When each patch was ready, with its tap bolts in place, it was lowered down to the diver, who merely directed it into position, the men inside withdrawing the wooden plugs so that the bolts could enter their proper holes. Then nuts and washers, with plenty of red lead, were placed upon the bolts and screwed well home in order to make the patch-plate snug and water-tight. With this done, the "pudge-boards" were removed and the ragged edges of the damaged hull cut away by means of oxy-acetylene flames. In this manner all of the repairs were effected, and the total damage covered an area of 700 square feet.

The "Royal George" left the St. Lawrence for Halifax, and on the way encountered heavy weather at sea, but Mr. Wotherspoon's repairs proved quite equal to the stresses placed upon them. At Halifax, because of the novelty of the work and to satisfy the insurance people, the liner was docked for a brief examination. Everything being found in excellent shape, the "Royal George" loaded with cargo and returned to England without further mishap.

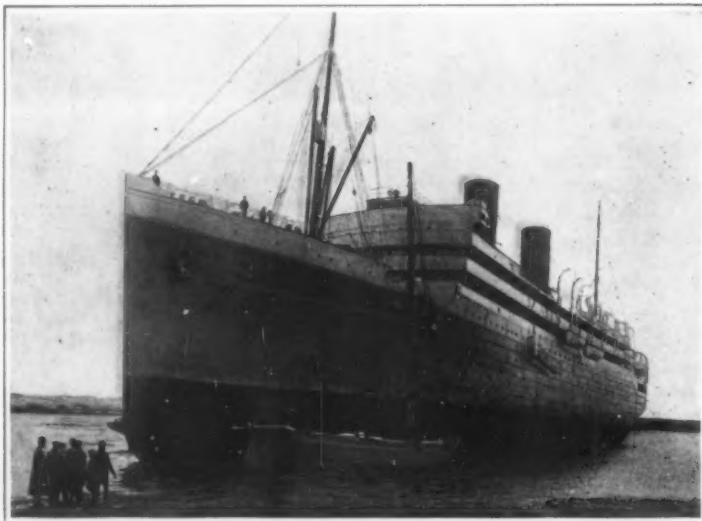
America's First Safety Exposition

THE First International Exposition of Safety and Sanitation ever held in America will take place in New York city, December 11th to 20th, 1913, under the auspices of the American Museum of Safety. Safety and health in every branch of American industrial life, manufacturing, trade, transportation on land and sea, business, engineering, in all of their subdivisions will be represented at this exposition. It will be the first step toward making a representative exhibition of the progress of safety and preventive methods in America.

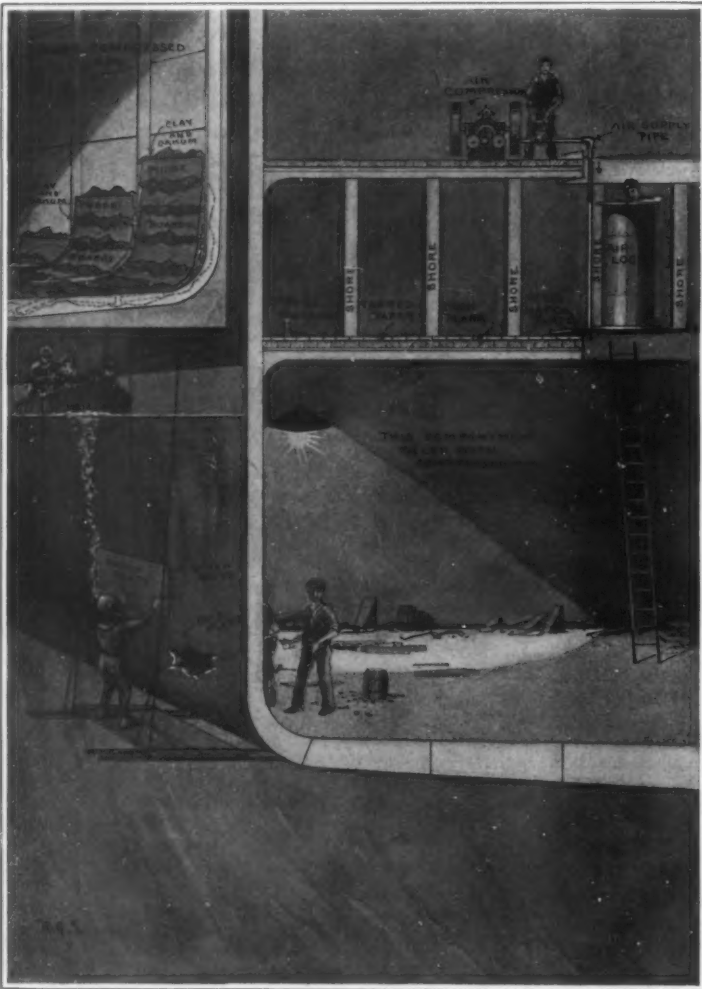
There will be absolutely no limit to the scope of the exposition. It will embrace everything devoted to safety, health, sanitation, accident prevention, welfare and the advancement of the science of industry.

By a special act of Congress, exhibits from Europe and other foreign countries are to be admitted free of duty. European employers have cut their accident and death rate in half by a persistent campaign for safety. There are twenty-one museums of safety in Europe. All of these various museums will contribute to the American exposition.

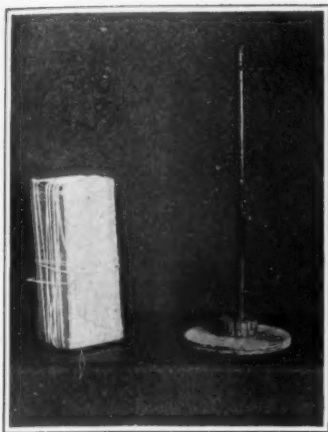
In the United States every year 40,000 workers are killed, and 2,000,000 are injured, while 3,000,000 are ill from preventable causes. A conservative estimate of the wasted wage earning capacity of the last for one year is four hundred million dollars. Thus it can be seen what America has to accomplish in the way of conserving human resources. The main object of the First International Exposition of Safety and Sanitation is to point the way for instituting organized safety methods in all departments of industrial work throughout the country.



The steamship "Royal George" on the rocks in the St. Lawrence River.



Showing how the "Royal George" was salvaged and repaired without dry-docking.



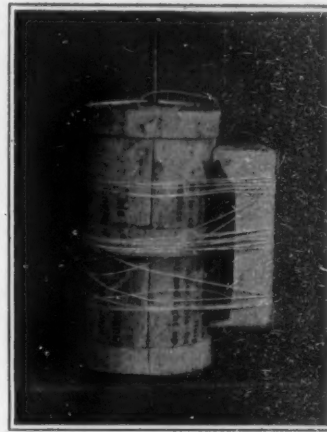
Steam chest, piston rod and piston fitted up.

Simple Methods in Model-making

How Soft Wood and Cardboard Can be Used

By Percy Collins

It often happens that an inventor cannot afford to have his ideas embodied in a working model by a professional model-maker. How one may make his own model, with scissors and paste, out of such materials as come to hand, is here explained. The methods are capable of many modifications to suit a variety of cases. The machines need not necessarily be very durable, so long as they can be made to operate and demonstrate the correctness of the inventor's theory, or expose serious faults that may be overcome before the patent is applied for.—EDITOR.



Cylinder with steam chest fixed in place.

THE object of this paper is to place before inventors and others who may be interested, the result of certain experiments in model-making which have been made with cardboard, soft wood and other easily obtained and easily worked materials. The construction of a model of machinery by the ordinary methods—the various parts being turned or cast in metal—is a laborious and often a costly undertaking. This fact is so well known that the inventor frequently hesitates to put his ideas to the preliminary test of a model, simply because the outlay which would be involved is beyond his means. Of course many inventors make their own models; but there are others who cannot do this because they lack the necessary practical experience in metal work. To these latter the following paragraphs are chiefly addressed. The writer has found, from experience, that many kinds of mechanical movements can be effectively illustrated by means of models made from simple materials that can be obtained practically without expense, and that can be cut and shaped with a sharp knife, a pair of scissors, a file and a sheet of fine glass-paper.

The simple methods adopted can be best explained by reference to the accompanying photographs which show the model of an old-style horizontal engine, together with the most important details of its construction. This model, which was originally made in order to teach some children the theory of the steam engine, and the names of its several parts, was built up entirely from scraps of wood, cardboard and pieces of steel knitting-needles. The only exception was the fly-wheel. This (it was an ordinary cast-iron wheel) was purchased at a general store, the cost being ten cents. The foundation of the engine was simply an oblong wooden box, in the lid of which two holes were cut—one for the fly-wheel, the other representing the crank-pit. When these holes had been cut out, the lid of the box was screwed permanently into place.

The various parts of the model were cut out in stout cardboard whenever this was feasible; but when greater strength was required, soft wood was used. Thus, the parts of the cylinder, steam-chest, etc., were made of cardboard, while those of the bearings, piston-head, guides, crank, etc., were of wood. It was often found desirable to cut out each part in two or more sections, and to join these subsequently by means of strong fish-glue. A detailed description of the manner in which the cylinder is made will give the reader a good idea of the method as a whole. First, a piece of cardboard tubing is required. A box of the kind in which a stick of shaving soap is sold, or an incandescent mantle box will do very well, though it may be necessary to reduce the length somewhat. The tube being in readiness, the piston and its rod should next be made. First (using compasses and scissors) cut out three circular pieces of card, one somewhat smaller than the other two, and gum these together to form the piston. Then, with a file, cut off a piece of knitting-needle somewhat longer

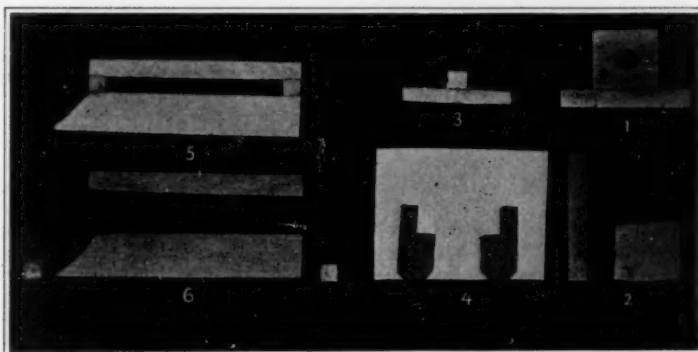
than the cylinder tube, and glue it firmly in an upright position to the piston, using a small piece of cork for support. When the glue is dry, proceed to fit up the cylinder. Two square pieces of card will be required, in one of which a round hole has been bored for the play of the piston-rod. Put the piston rod through this hole, insert the piston into the cylinder, and glue down the square cover. The other square of cardboard should

now be glued to the other end of the cylinder; and when the glue is quite set, the overlap of both covers should be neatly trimmed away by means of scissors or a sharp knife. Thereafter the bands can be glued round the cylinder, and the steam chest cut out and fitted into place.

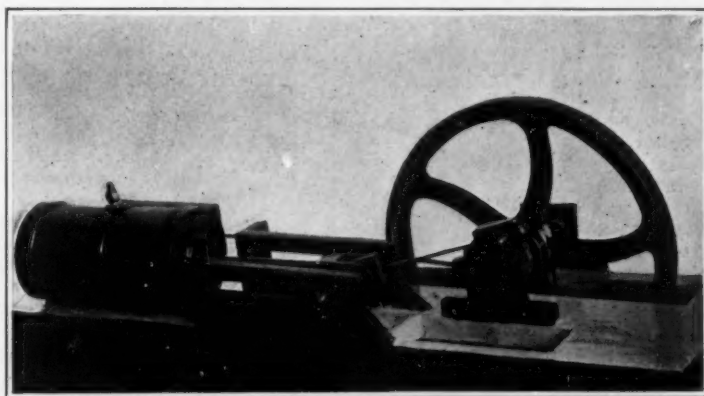
All these points are illustrated in the photographs reproduced on this page. But it is unnecessary to describe the whole of the work in detail, chiefly for the reason that the reader will be likely to modify the methods to suit his own convenience. Enough has been written to render intelligible the manner in which a model of this kind can be made. One or two points, however, call for emphasis. It is a wise precaution to purchase the fly-wheel before work is commenced, the reason being that the size of the wheel will necessarily be our guide when we plot out the dimensions of the other parts. Once the size of the fly-wheel is known, it is a simple matter to determine the appropriate bore of the cylinder, stroke of piston, etc. When making the necessary holes in wood or cardboard, the best plan is to use a red-hot knitting-needle slightly smaller as to size than the hole that we require. The glue used in model-making should be the strongest and best obtainable. As to the finishing of the work, it may be said that each part should be first rubbed down carefully with fine glass-paper, then coated with size, and finally rubbed down again. In this way all rough edges may be removed, and a uniformly smooth surface obtained. This remark will be found to apply as much to cardboard as to wood. Lastly, the model should receive a coat of enamel, which will be found to lie evenly and well upon the sized surface.

The full details of the slide-valve and eccentric gear were not attempted in the particular model shown in the photographs. This model was intended to be driven by means of a small electric motor; and as it was to be used merely for purposes of elementary instruction, only sufficient details were reproduced to meet the particular ends in view. But it has been found that a working model cylinder, driven by compressed air, can quite easily be made from cardboard. It need scarcely be added, however, that the internal mechanism of the cylinder and steam-chest must be constructed with great care and accuracy. The necessary smooth, metal-like surface may be imparted to the cardboard by rubbing all the friction surfaces with blacklead.

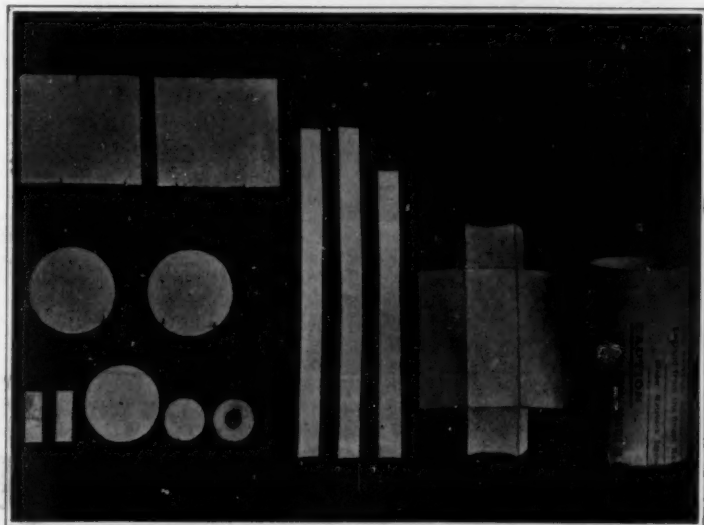
The reader who has followed carefully the instructions given above will find that he is able, after a little practice, to construct models of many kinds of engines and machines by using the simple materials which have been mentioned. It is quite possible to make a model factory, with every part of the equipment duly to scale, and all the machinery capable of being shown in motion. One may also make a working miniature of a machine whose movements are too complicated to be demonstrated on a drawing and prove or disprove his theories to his satisfaction.



Parts of the bearings, cross-head and guides.



The finished wood and paper model-engine.



Parts of the cylinder and steam chest ready to be fitted together.

Federal Regulations for Protection of Migratory Birds

THE Department of Agriculture announces the selection of fifteen experts to advise the Secretary in framing regulations to make the new Federal protection of migratory birds effective. To these men, who will serve without remuneration, will be referred certain questions arising in connection with the tentative regulations recently published by the Department in connection with the act of March 4th, which gives the Federal Government jurisdiction over the migratory birds of the United States. The fifteen men selected, and who have already consented to assist in this advisory capacity, are as follows:

John B. Burnham, New York city, president of the American Game Protective and Propagation Association, chairman; F. W. Chambers, State Fish and Game Commissioner, Salt Lake City, Utah; Prof. L. L. Dyche, State Fish and Game Warden, Pratt, Kans.; W. L. Finley, State Game Warden, Portland, Ore.; E. H. Forbush, State Ornithologist, Boston, Mass.; Dr. George Bird Grinnell, New York, vice-president of the Boone and Crockett Club, and former editor of *Forest and Stream*; Dr. William T. Hornaday, New York, director of the New York Zoological Park; Hon. John F. Lacey, Oskaloosa, Iowa, author of the Lacey act regulating importation and interstate commerce in birds and game; Marshall McLean, New York, chairman Committee on Conservation of Wild Life of the Camp-Fire Club of America; T. Gilbert Pearson, New York, secretary National Association of Audubon Societies; Hon. George Shiras, 3rd, Washington, D. C., author of the original bill protecting migratory birds; Gen. John C. Speaks, chief warden, Columbus, Ohio; William P. Taylor, Berkeley, Cal., chairman Committee on Conservation of Wild Life in California; Hon. John H. Wallace, State Game and Fish Commissioner, Montgomery, Ala.; Major Bluford Wilson, Springfield, Ill.

The proposed regulations, in the final adoption of which and in the hearings on which these gentlemen will act in an advisory capacity to the Department, and which do not go into effect before October 1st, 1913, are designed to secure the following results:

1. Uniformity in protection of migratory game and insectivorous birds in the several States.
2. Protection of birds in spring while en route to their nesting grounds and while mating.
3. Uniformity in protection of migratory birds at night.
4. Establishment of protected migration routes along three great rivers in the central United States.
5. Complete protection for five years for the smaller shore birds and other species which have become greatly reduced in numbers.
6. Reduction of the open season on migratory game birds, but in most cases not more than 25 to 50 per cent.

Saving Our Natural Gas

WHAT is believed to be a most notable demonstration of the conservation of the mineral resources of the country has just been accomplished by the United States Bureau of Mines in the State of Oklahoma.

A. J. Pollard of Bakersfield, California, and A. G. Heggen of Pittsburgh, Pa., the two oil experts of the Bureau, acting under the direction of Dr. Joseph A. Holmes, have succeeded in stopping the waste of more than 150,000,000 cubic feet of natural gas daily. This gas is worth \$37,500 for every day it is wasted and nearly \$13,000,000 in a year's time.

When the Bureau's experts entered the field it is estimated that 250,000,000 cubic feet of gas was being wasted, valued at about \$62,500, for every twenty-four hours, or about \$23,000,000 a year. All of this will eventually be saved.

The gas already saved is equivalent in heat value in a year's time to 1,875,000 tons of the best coal, and before the advent of the Bureau's men Oklahoma was wasting fuel equal to 3,125,000 tons of coal.

The operators and drillers after much skepticism have now reached the conclusion that the Federal experts' method of drilling is the proper one, and they are making preparations to stop the remainder of the waste of natural gas. The necessary apparatus is being rapidly purchased, and so enthusiastic have the operators become, they have requested Secretary Lane of the Interior Department to retain Mr. Pollard, one of the Bureau's experts, in Oklahoma until more demonstrations can be given.

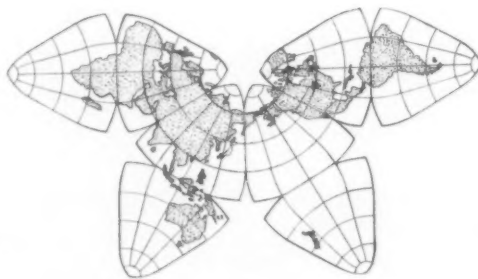
The Federal experts have successfully directed the drilling of two wells in which there would have been a combined waste of more than 20,000,000 cubic feet of natural gas daily under the old methods. They have succeeded in shutting off the gas in these wells and have drilled the well below the gas strata and into the oil. They have also directed the drilling of a number of other wells past the strata and without a waste of any of the gas.

The system in brief is the pumping of a mud-laden

fluid into the well in such a manner that it stops the gas from penetrating the well. In the past it is declared that in a great number of wells drilled in the Cushing field in the gas zone it has been found impossible to drill entirely through the gas formation, due to the pressure and volume of the gas. In a number of instances it has been necessary to shut down the well, and the money spent in drilling has been lost. Loss from this cause in the future will be avoided by the adoption of the system recommended by the Federal experts. It is further claimed that the method urged by the Government will cost the oil men less and that there will be less risk than with the method which has been in vogue.

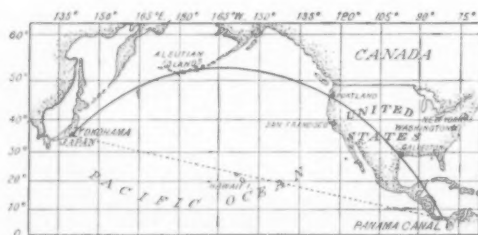
Mapping the Sphere on a Plane

GERHARD KREMER or "Gerardus Mercator," as the fifteenth century mathematician and geographer preferred to be called, conferred a doubtful blessing on the earth when he invented his sailing chart with the parallels of latitude intersected at right angles by parallel meridians. His map filled a certain need of the seaman, but he could not have done more to confuse our ideas of geography. Thanks to the Mercator projection, which has found its way into the school geographies, because it shows the whole world in a



The "butterfly map" of the world.

single view, one gets the notion that Canada is twice as big as the United States, that Greenland is fully as big as Africa, and that Alaska is much larger than Australia. As a matter of fact the area of Canada is less than that of the United States, and Africa is much larger than the whole of North America, while Greenland and Alaska combined would not equal half the area of Australia. Norway and Sweden, which on the map look like a great bear creeping out of the frozen North to gobble up the small States bordering the North Sea, are actually only half the size of the State of Venezuela in South America. Outside of Russia



The shortest course between the Panama Canal and Yokohama passes through the Aleutian Islands.

there is not a single country in Europe half as big as Colombia.

All our geographical conceptions are due to the fact that the Mercator projection makes it necessary to expand the polar regions of the earth to the full extent of the equator. Not only are our impressions of the relative sizes of land areas greatly distorted, but we are also misled as to the relative positions of various locations and the shortest course to pursue in traveling from one point to another. For instance, a school-boy would tell us that the shortest course between the Panama Canal and Yokohama, Japan, would take us through Hawaii, and you could not make him believe otherwise without showing him a globe and letting him stretch a string from one point to the other, when, much to his surprise, he would find that the shortest course would be to travel back through the canal to its Atlantic end, taking a northwesterly course that would carry him near Galveston, and up to Portland before he struck the Pacific Ocean, thence up through the Aleutian Islands. The accompanying map is a Mercator projection of a part of the earth, showing the apparently shortest course between the Panama Canal and Yokohama by a dotted line and the really shortest course with a heavy full line. On a globe it is easy to see that the bulge of the earth makes the dotted course considerably longer than that shown by the full line.

The whole difficulty lies in the attempt to represent the surface of a sphere on a plane, which it is physically impossible to do. Mercator converted the globe into an imaginary cylinder, then he slit open his cylinder and spread it out flat into a plane. Other methods have been developed, the most common of which is to show the world in two hemispheres, but this is not true for the reason that it does not show the bulge of the earth, and if it did the land lying near the borders of the map would have to be shown on edge. Furthermore, the entire world is not shown in a single view, but in two separate views that touch only at the equator. Other attempts at mapping the entire world in a single chart consist in showing it as a large oval with a diameter along the equator twice that of the earth's axis, or of showing the entire earth on a single hemisphere, with the parallels of latitude further and further apart as we approach the poles. Still another method is to make the map of a series of gores, usually a dozen of them connected at the equator, just as if we should peel an orange in lobes by following meridians from pole to pole, but without quite cutting through the skin at the equator. This band of connected lobes, if laid flat, would give a true measure of the relative areas of the different land bodies, but they would be so cut up, particularly in the northern regions, that it would be difficult to get at any adequate conception of the actual shape of the continents.

Recently a new form of land map of the world has been developed. It is known as the "butterfly map" and was originated by B. J. S. Cahill, an architect, living in San Francisco. Because of this contribution to geography, Mr. Cahill has just been elected a fellow of the Royal Geographical Society of London. The map is similar to that of the orange lobes, except that fewer lobes are used, and instead of being connected at the equator, they are connected in the northern temperate zone, so that no large body of land, with the exception of one edge of Greenland, is cut by the lines which divide the map into sections. Mr. Cahill originally made this map out of a rubber ball, a couple of inches in diameter. On this he scribed lines of latitude and longitude, 22½ degrees apart, and drew in the map of the world. The equator was represented by a red line, the meridian 22½ degrees west of Greenwich by another red line that was extended around the earth, and a third red line was put in at right angles to both of these great circles, which would bring it to 102½ degrees west of Greenwich. Where these three great circles intersected, the ball was cut with a sharp knife along each line for a distance of 22½ degrees from the point of intersection. This divided the globe into eight equal parts, four north and four south of the equator. The cuts were then continued southward to liberate the four southern lobes, and one of the cuts was continued northward so that the globe could be opened out and laid flat, as shown in the illustration. So little was the distortion when the globe was flattened out, that even the paint on the surface of the ball did not crack. On releasing the map, it jumped back to its spherical form, becoming a globe again. On examining this map, it is easy to see how much shorter is the course from the Panama Canal to Yokohama by way of the Aleutian Islands than by way of Hawaii. The "butterfly" projection shows how the land radiates from the north pole in three streamers. It represents the best attempt so far to map the globe on a plane.

Texas Sulphur

TEXAS is destined to play an important part in the production of sulphur for the world's consumption. Beginning on November 19th, 1912, sulphur in paying quantities has been mined from the Freeport Sulphur Company's new field at Bryan Heights, near Freeport, Texas.

This latest large deposit to be worked for commercial and industrial purposes is located about three miles from the mouth of the Brazos River, the largest navigable river west of the Mississippi, and within view of the Gulf of Mexico. The sulphur deposit is practically located at tide water.

The sulphur at this mine is found under conditions very similar to those existing in Calcasieu Parish, Louisiana, which mine was recently fully described in the SCIENTIFIC AMERICAN.

The area of the Texas deposit is something over 600 acres, and the sulphur content of this mine is probably somewhere in the vicinity of seventeen million tons.

The process of mining used at the Texas field is that of introducing hot water into the formation and removing the sulphur in a molten state by pumping it to the surface. The basic system of mining by this process was patented by Herman Frasch in 1892, the patents for which expired in 1909. At the Freeport Sulphur Company's mine, however, the application of the process differs in some respects from that used by Mr. Frasch, and the same results are arrived at by somewhat different methods.

The Elevated Sidewalk

By Henry Harrison Suplee

ONE of the greatest impediments to city transport to-day is the continuance of the obsolete method of attempting to conduct foot and vehicular traffic upon the same highways.

The engineer, who has occasion to design conduits for inanimate particles, knows very well that he will have trouble if he tries to convey steam and water through the same pipe; and if he wishes a satisfactory and silent circulation in a steam heating system, for example, he provides separate return pipes for the out-flowing steam and the returning water of condensation. It is only beginning to appear, however, that the same laws which are recognized for steam, air, water, gas, etc., hold good also for the flow of human molecules which constitute the elements of the contents of a modern crowded street.

In nearly every large city to-day there appears a tendency to enforce traffic regulations intended to permit the most conflicting elements to be operated together, and the result is naturally the impeding of the very traffic which it is desired to help.

The very general introduction of electric street cars, and the tremendous increase in the number of automobiles, might well be supposed to improve the means of getting about, but as these facilities are increased there appears to come with them a continual increase in plans for reducing their efficiency.

Thus, the automobile enables far higher speeds to be attained, both for persons and for merchandise, than could be secured by the older means of transport. Instead of welcoming and utilizing this advantage, there immediately appears, on the contrary, such speed limitations and traffic regulations as act to neutralize very largely the great improvement which has been developed. The ostensible reason for such obstructive methods is the safeguarding of the foot passenger; the real reason is the attempt to conduct the modern and the antiquated methods of locomotion upon the same highway, thus imposing upon the machine the limitations of the man.

If such a plan had been tried with the steam railway, all the forebodings of the conservative element of the early nineteenth century would have been realized, but fortunately the railways were enabled to use their own right of way, and the advantages of the application of steam to transport were not lost to society.

If the real capacity of power-propelled machinery is to be gained in transport in cities, there is one fundamental condition which must be observed: the segregation of foot and vehicular traffic. This is such a simple and obvious proposition, and has been so successfully applied in certain isolated cases already, that it seems most surprising that it has not been put into general use.

Take the foot passengers off the surface of the streets entirely; and leave the highways solely for vehicles!

This permits, at once, the removal of speed limitations, so that traffic regulations may be framed for but one kind of transport, thus immensely simplifying this portion of the problem. Since we may assume that, for economic and sanitary reasons, the horse will soon disappear altogether from city limits, the surface of the streets would then be used entirely by power-propelled vehicles, and it becomes necessary to provide elevated sidewalks for the pedestrians. Such elevated sidewalks need not be heavy or costly, and would leave the entire middle of the street open, with possibly openings at points along the building line as well. The pedestrian would thus have a level, continuous walk, bridging all streets, and remaining unobstructed at all points at all times.

The feasibility of such a plan needs no argument; it requires only a visit to any one of the great bridges crossing the East River at New York, or a promenade upon a "boardwalk" at any seaside resort, to speak for itself. In the city, however, it offers such special advantages as to demand further emphasis.

The provision of a perfectly safe, smooth, and accessible sidewalk, at the first floor level of all buildings, would add immensely to the value of store fronts, and solve many of the problems of shop and residence construction in cities. Many people would gladly walk considerable distances upon such a free and safe path, who now dread the dangers of street crossings. The removal of an important cause of surface congestion would permit so much greater freedom of traffic upon the highways, that the efficiency of automobile vehicles would be greatly enhanced. The electric cars, given the middle of the streets, would deliver their passengers, not across the path of the speeding automobiles to the surface sidewalks, but to the middle space, permitting direct ascent to the elevated sidewalk level, so that no obstructing rules governing the passing of cars by other vehicles need be enforced. Each type of transport would be free to develop itself along its own lines, unobstructed by the limitations of others.

The simple, elementary laws of the transport of

fluids, providing separate conduits for different kinds, need only application to the flow of people, to permit their rational and satisfactory operation. An important feature in the possible installation of elevated sidewalks in a city such as New York, appears in the manner in which it might be constructed gradually, as demanded. Thus, such sidewalks might be built on Broadway from the Battery to Union Square, there sloping down to the surface level until further extensions were required. As each new section were added, it could be put into immediate use, thus differing from any important construction which cannot be used until wholly completed.

An important extension of the principle, and possibly one which might be first put into operation, would be the introduction of a system of bridges connecting the upper floors of tall buildings. If, say, at the tenth floor level, the cross streets were spanned by foot bridges of ample width, enabling foot traffic to pass freely along, without descending to the lower levels, there would be a marked relief to the surface congestion. Many people would remain upon the upper levels during the noon hours, taking luncheon at some convenient restaurant or club upon the higher floors, and walking a portion of the distance up town at night, and the distribution of elevator service thus effected might be found most advantageous. For many purposes such an upper traffic level would increase the values of the corresponding floors of the buildings, since such upper floors would become another street level for business and for the display of merchandise.

Apart from the advantages already enumerated, the segregation of foot from vehicular traffic upon different levels should lead to further developments. It has been felt by many that the continued construction of tall buildings, both for business and for residence, would inevitably result in darkened streets, congested living quarters, and other disadvantages. If, however, the necessity for descending were removed, at least until the more congested quarters were passed, many of the objections to tall buildings would disappear. The lower floors would follow the tendency already beginning to appear, and be used for storage, for the handling of heavy merchandise, and similar purposes, freed from the disadvantages of obstructing foot traffic, while the facility afforded for free and safe movement at higher levels for business, shopping, eating, and residence, would restore the pedestrian to the brighter light, purer air, and safer movement formerly enjoyed upon the surface.

It is possible that, upon some intermediate level, the "flying road" in the form of the traveling platform, might follow the general uplift; while more remotely, but yet not beyond practical vision, may appear the coming of aerial transport.

One thing must be firmly understood, however, that the principle of absolute segregation of foot travel from any kind of vehicles is essential for relief, and that any plan which proposes to place both automobiles and pedestrians upon the same level, would be fatal to success. The power vehicles should be kept absolutely to the surface, and there given unrestricted facilities for speed, weight, and numbers; and the foot levels maintained for absolute freedom for pedestrians, with the possible exception of carriages for small children.

The reality of the problem which is already awaiting solution, will be appreciated when it is understood that a single modern structure, such as the Woolworth Building, New York, contains 10,000 people, the population of a good-sized town, and that all these people must enter and leave at least once a day, and many of them more frequently. Such problems of congestion are not to be met by the enactment and enforcement of rules and regulations restricting and impeding the automobiles or street cars, the very means by which, if unrestricted, much of the traffic might be relieved.

Rather, the opportunity for full speed and freedom of movement should be given; as it can be by taking the foot passenger wholly out of the way, and giving to him also that greater freedom and entire safety to which he is entitled.

The Current Supplement

MUCH evidence points to a point 273 deg. Cent. below the freezing point of water as the absolute zero of temperature. Cold approaching this presumably prevails in interstellar space, and has also been produced in the laboratory. Reflections upon these facts form the subject of an article in this week's issue of the SCIENTIFIC AMERICAN SUPPLEMENT.—Dr. A. Gleich writes on "The Human Eye and the Photographic Camera—Points of Similarity and of Difference."—An account of the measurement of the luminosity of the glow-worm is given by H. E. Ives and C. W. Jordan, showing that this creature is fifty times more efficient than our best light sources.—A laboratory for research in optics and photography, just completed by one of our large manufacturing firms, is described, and the scope of its work outlined.—Prof. Haber describes his process for the synthetic production of ammonia.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

An Opinion on Price Cutting

To the Editor of the SCIENTIFIC AMERICAN:

Legislation that looks toward the abolishment of price maintenance by the manufacturer is a blow at legitimate merchandising. It means death to the small retailer and distributor and confiscation to the manufacturer, and is unfair to the public. It fosters and encourages substitution and adulteration. Wrong in principle and vicious in practice.

S. C. DOBBS, Sales Manager Coca Cola Co.
Atlanta, Ga.

A Suggestion for Flood Prevention

To the Editor of the SCIENTIFIC AMERICAN:

Like Mr. F. A. Day of Ohio, I have followed with interest the various articles on flood prevention, and have often wondered why no one mentioned the plan which he suggests in your issue of June 28th. It seems to me by far the most practical plan so far suggested.

I am not acquainted with the middle West to any extent, but in most places the streams flow through numerous flat meadows admirably adapted to such a scheme, with benefit both to the meadow land and to the country below.

Could not Mr. Day's plan be improved upon, however, by building the dam entirely across the foot of the meadow and providing a suitable culvert in the stream bed of such size as to carry a little more than the normal flow of water. Then if the stream rose above a certain height the additional flow would spread over the meadow until the water had risen to the spillway which would be provided in the top of the dam. In the same way the receding water would flow out gradually till the basin was empty. By providing larger culverts at certain points part of the meadows along a stream would be overflowed only in times of extraordinary flood. In this way the entire action could be made automatic, no attendance being required for closing flood gates, etc.

Southbridge, Mass.

H. F. AMMIDOWN.

Solar Physics Observatory for New Zealand

To the Editor of the SCIENTIFIC AMERICAN:

It may interest you to know that owing to the generosity of Mr. Thomas Cawthron of Nelson, New Zealand, a solar physics observatory is to be erected in this part of the world. He has promised to build, equip and endow a solar physics observatory, at a cost of about ten to twelve thousand pounds. The site will probably be on a summit known as "The Fringe," at an elevation of 2,500 feet above sea-level, and easily accessible. The annual average of direct sunshine is 2,500 hours, and the rain register annual average during the past thirty years is 37.88 inches. Nelson has been termed the climate paradise of New Zealand, and according to Prof. Archibald, the well-known meteorologist, Nelson is very suitable for the establishment of a solar observatory.

MARY PROCTOR.

159 Collingwood St., Nelson, New Zealand.

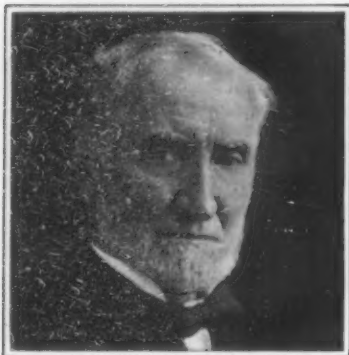
A Few Words of Appreciation

To the Editor of the SCIENTIFIC AMERICAN:

I cannot resist the temptation of inflicting another letter to let you know how I appreciate some things you have recently published. Some issues back you published a recipe for "Salt-rising Light Bread" that has been worth the subscription price of the SCIENTIFIC AMERICAN for many years to us. In your issue of May 31st you have an article entitled "The Embroidery of Knowledge," which I think very appropriate and useful. There is a sentiment gaining ground that the boy should be taught first how to make a dollar and then how to keep it. Now if we become only a nation of money seekers, what will we be but a race of human hogs? All esthetic sentiment and refinement will soon be gone. When wealth is the only object of ambition, any method of obtaining it is countenanced, and so there arise many evil practices among the people. I have the first astronomy I studied at school with a frontispiece map giving the sublime home of the mythological gods. I next got interested in this matter in the *Æneid* of Virgil; have since followed it up in Dante, Shakespeare, Homer, and others, as well as the more prosaic works of Anthon, William Smith, Lempriere, etc. Much pleasure has it given me. The man who wrote that article has my heartfelt thanks and best wishes in all respects.

W. R. SMITH.

Woodbury, Tenn.



Copyright by Harris and Ewing.
1—A conservative, persistent, reserved type. A good example of hard consistency. (Note severity in expression of face; especially of the mouth.)



2—Mental-philosophical type of soft-elastic consistency. A sympathetic, optimistic, responsive and emotional man, who would not harmonize with the type pictured in No. 1.



Copyright by Harris and Ewing.
3—Decisive. Keen sense of justice. The vital or judicial type. Not easily convinced and not easily changed in viewpoint. (Note roundness of features.)



Copyright by Harris and Ewing.
4—Another example of the vital type. Speculative and aggressive. Very obstinate. A good financier. A man not easily influenced.



5—Convex type. Artistic in his inclinations and strong in his appetites. Interested chiefly in himself.



6—A type which is patient, persistent, insistent, tenacious, just and deliberating, critical and imaginative. Good example of concave type. (Note prominence of upper forehead and chin.)



7—Convex upper and concave lower face. A man who is original, a keen observer, tenacious, courageous and broad-minded.



Photo. by Pirie MacDonald.
8—A distinguished electrical engineer. A well-balanced type. Persuasive and philosophical.

The Scientific Employment of Men

Standardizing Human Character

By Herbert Newton

PICK up any daily newspaper published in any large American city and you may read dozens of advertisements worded thus:

WANTED—Entry clerk in receiving department of wholesale drygoods house. Not over forty. Must be conscientious, accurate, and experienced. Address X. Y. Z., Box 241, The Planet, Uptown Office.

A hundred applicants write. Those whose letters are least ungrammatical are invited to "call and see our Mr. Jackson between nine and ten o'clock to-morrow morning." They duly appear. Mr. Jackson looks his men over. The old ones, the shabby ones, the drowsy looking ones, are promptly dismissed. Mr. Jackson may be right or wrong in disposing of them thus summarily. The rest he questions. Invariably he asks: "What is your experience?" Finally he selects a man not unattractive in appearance, one who has been in the drygoods business for five years.

Will the man stay in his new place? Will he be acceptable to his fellow workers? Can he be counted upon in an emergency? Will he have the interests of the house at heart? Only time can tell; not Mr. Jackson.

This is the time-honored "hiring and firing" method—wasteful and expensive. But is there anything better? Is there any way of standardizing men as machines and materials are standardized? Is there any way of specifying human characteristics as accurately as belting and steel are specified for a machine shop?

Business men have thus far interested themselves but little in this matter. Theirs are still the hit and miss methods of antiquity. They try a man for a time, which is equivalent to sampling a patent medicine or demonstrating a machine, and they cherish the illusion that they are proceeding in a practical business-like way.

The sales manager of one large firm once tried three hundred candidates before he succeeded in obtaining an even passably efficient force of twenty-five salesmen. The cost of engaging, partially training, and finally weeding out the 275 unfit amounted to over \$30,000. This was the actual money lost. The waste of time, energy and opportunity for profitable sales can be scarcely estimated.

Business men forget that the demonstration method is expensive and that it may sometimes prove disastrous. Sometimes they try to cast upon another the cost of demonstrating a man's fitness. Hence, it is a common practice to appropriate men who have demonstrated their ability in some enterprise. Where would the American navy be if it attempted to officer its ships by appropriating British, French, and Japanese officers of ability?

Selection on a basis of experience (Mr. Jackson's method) is common, but equally unsatisfactory. Better a pedigreed colt from racing stock than an experienced cart horse if racing is the function required. The truth is that experience without aptitude is worth little; and that aptitude without experience may be worth much. Experience is important, but it is easily acquired when there is aptitude, days or weeks giving a proficiency not otherwise accumulated in months or years. But how can aptitudes be judged? Psychological tests have been advocated, but their application is exceedingly limited. A man is not necessarily a good locomotive engineer because he can distinguish red from green and because he responds quickly to signals. No psychological instrument thus far devised can determine whether he is careful, whether he has presence of mind, whether he is trustworthy.

Ideally, an efficient commercial or industrial organization is correctly designed as to functions and their inter-relation. Each individual in the organization, whether executive or subordinate, is fitted by natural aptitudes, training and experience for his function, and all are associated with reference to their common adaptability and harmonious co-operation. Engineers, executives and organizers have worked on the problem of design until it now approaches the ideal. The chart of organization with line and staff functions devised by Mr. Harrington Emerson and the functional foremanship plan of Mr. Frederick W. Taylor are examples.

It remained for someone to bring the problem of scientific selection and assignment of employees out of chaos and haphazard methods into scientific efficiency. This has been and is being done practically in several large commercial organizations, according to a plan originated and made the basis of employment departments by Dr. Katherine M. H. Blackford.

Dr. Blackford proceeds on the principle that "the largest sums of money, the finest materials, the latest and best equipment, the most cleverly and intelli-



Copyright by Harris and Ewing.
9—Determined. Liberty-loving. A natural pioneer. The motive type. (Note squareness of features with long lines.)



Photo. by Pirie MacDonald.
10—A well-known electrical engineer, a good example of the motive type.

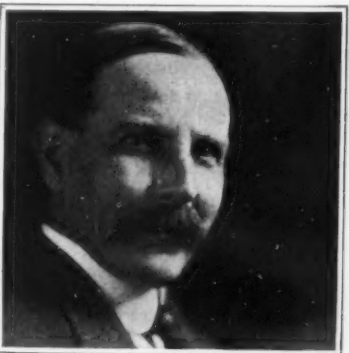


Photo. by Pirie MacDonald.
11—A well-known engineer of the educator type. Affable, tactful, and popular.



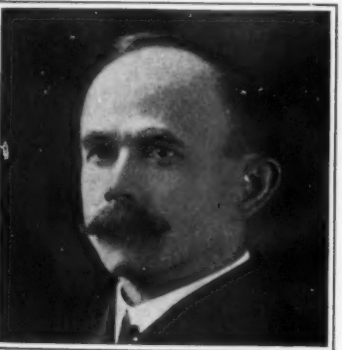
12—A good example of the professional type. A scientist with a passion for facts. (Note prominence of brow.)



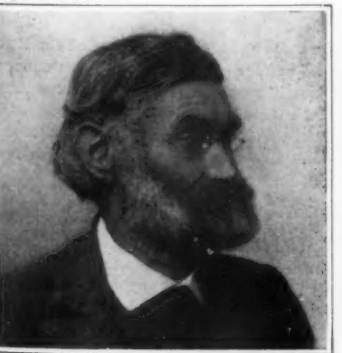
13—Enthusiasm and idealism, coupled with business ability, are disclosed by this type. He and the type shown in 14 are harmonious.



Photo by Pirie MacDonald.
14—A good example of the triangular mental type. Very sensitive. Imaginative. Decided in his views. Excellent sense of proportion.



Copyright by Harris and Ewing.
15—A good example of fine texture. Idealistic. Humanitarian. A natural educator. Fine example of mental type. (Note triangular features.)



16—Concave, idealistic type. A man whose social ideals were so high that he converted his entire fortune into a trust fund for the benefit of his employees.



17—Convex, motive, brunette type. A daring pioneer. Original, shrewd, and penetrating. Keenly interested in facts, inclined to skepticism, but open to conviction. Lover of liberty.

gently devised methods will not be efficient unless there are men fitted by nature and training for their tasks, in the right places at the right time, and with the right training, guidance, direction, and supervision." How different is this point of view from that usually entertained! The manufacturer is prone to place his labor supply in the same category as his supply of raw material, and to think no more about it than to be sure that there are men enough to run his machines and to do his work. To the consideration of the relative cost and efficiency of two machines he will give hours; to the choice of men to run the machines he will devote scarcely ten minutes.

It is obviously unscientific to place men and women in an organization without reference to their fitness. It is also deplorably wasteful of time and money of the employer and of time, energy and psychical inspiration of the employee. Mr. Harrington Emerson has estimated that "the yearly money lost in direct cost on the average machinist of only 30 per cent efficiency (not by any means an unusual standing) is nearly \$5,000; not counting the loss of profit on output. This loss in efficiency increases as the position becomes one of greater importance." It is but one step in advance to use the cut and try or "hire and fire" method of selection by requiring actual demonstration of fitness on the part of the employee.

Dr. Blackford has for thirteen years carefully studied men and women at their work, in their amusements, in their mental and physical ailments and abnormalities, in their religion, in their social and commercial relationships and in their crimes. She has studied them in all vocations, in all parts of the United States and Canada, and, during a tour of the world, in eighteen foreign countries. In her files she has details and complete records of her examinations of 15,000 persons, and summarized and classified records of her observations of upward of 50,000 more.

As the result of her studies she has devised a scientific method of judging character, a method which yields accurate, clear, and easily applicable information as to the requirements—in human aptitudes, training and experience—of each function in the organization; which provides for the selection of human material by methods for determining its inherent and acquired qualities; which can be taught to intelligent examiners and used in analysis rapidly, unobtrusively, and without requiring more than passive co-operation on the part of the applicant; and lastly which provides the management of any organization accurate information as a basis for associating workers and executives in such a way as to realize the greatest possible efficiency from each.

The system which she has devised deals entirely with externals. In an intuitive way we all recognize the value of external characteristics in judging human capabilities. Even our language indicates it. The "roving blue eye" is not an empty phrase. The words "thick skinned" and "thin skinned" connote both physical and psychical degrees of sensitivity. The sensitive, delicate minded man usually has a fine textured skin; the coarse-minded man a coarse textured skin. It is an embryological fact that the skin was and is the original seat of all sensations, and that spinal cords and nerves are but modified and specialized intuned skin. Of necessity a man's skin indicates the texture of his brain. Dr. Blackford holds: "It is a law of human nature having universal application that the size, color, proportion, form, texture, consistency and structure of an object indicate its function and use."

As the result of all her investigations and studies she has determined upon nine fundamental physical properties, variations and combinations of which indicate the characteristics not only of human beings, but of all other material objects, whether animate or inanimate. These nine fundamental properties are texture, size, color, form, structure, consistency, proportion, expression and experience or use.

Each of these nine properties has a distinct manifestation in every person. For example, texture may be fine, medium or coarse. Size may be large or small and all degrees between. Form may be extremely convex in general tendency or extremely concave, with all extremes of convexity and concavity, and with all combinations of convex and concave features of face and body.

Structure may be slight and delicate, square, bony, and muscular, round and corpulent, or any degree and combination of these. Consistency may be very hard, very soft, elastic or varying gradation of these. In proportion we find almost every possible combination of proportions of different parts of the body, head, and face to one another. Expression has almost as many variations as there are people, as does also experience.

Dr. Blackford's investigations indicate that each of the nine elements she enumerates is indicative of certain inborn or acquired characteristics of the individual.

For example, she points out, texture is a great classifier of humanity. The individual of fine hair, fine textured skin, delicately chiseled features, slender, graceful body and limbs, as a general rule, is refined, loves beauty and grace, and likes work either purely mental in its nature, or offering an opportunity to handle fine, delicate materials and tools. On the other hand, the man with coarse hair, coarse textured skin, and large, strongly formed features inclines as a general rule to occupations in which strength, vigor, virility, and ability to live and work in the midst of harsh, rough, and unbecoming conditions are prime requirements.

Mark well in this statement, however, the qualifying phrase, "as a general rule." Other elements besides texture may modify the final result. Also note well that these are merely suggestive examples of all of the many things that texture may indicate in the individual.

Some similarly suggestive indications of the other properties may also be given.

In size, men of small stature and light weight are obviously adapted to light work, and work requiring quickness and agility, while men of large stature and heavy weight are adapted to lifting and moving about large and heavy masses of material when engaged in physical work.

It is no secret to observant employers of labor that blondes, as a general rule, are changeable, variety loving, optimistic, and speculative, while brunettes are consistent, steady, dependable, serious, and conservative.

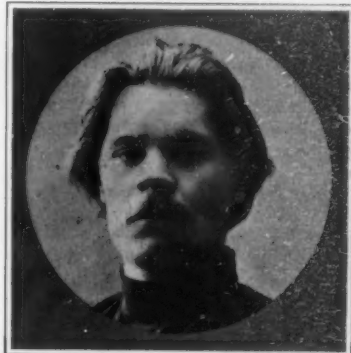
Form is evidenced in the shape of the features, and of the entire body. It requires no scientist to observe that the greyhound is quicker, more responsive, and less enduring than the bulldog. And it turns out, as one might naturally expect, that the man who resembles the greyhound in form is quicker, keener, more responsive, and less enduring than the man who resembles the bulldog in form.

A most cursory examination of the portraits of poets, educators, and essayists will show a marked general tendency in them to resemble the triangle in structure of head and body—both head and body wide above and narrower in the lower

(Continued on page 75.)



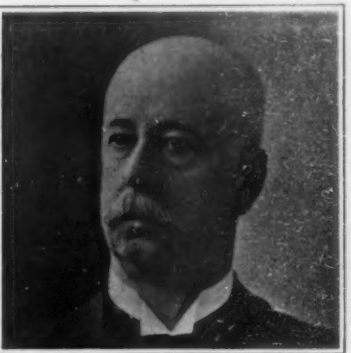
18—The fine textured sensitive artist type. Quick, kind, and responsive.



19—Russian motive type, of coarse texture; forceful, vigorous, and unrefined.



20—An executive of fine texture who wins and holds the loyalty of all grades of workmen.



21—A good example of the promoter type—constructive and imaginative.



22—The commercial type—shrewdness, foresight and executive ability combined.

Colonel Goethals' Private Car

"THE YELLOW DEVIL" is the pet name by which Panama Canal workers know the private motor car of Colonel Goethals. It is apparently a combination of automobile and "dinky," as it has a powerful gas engine with hood like an automobile and a cowcatcher like a locomotive. It runs on the tracks of the Panama Railroad and will take the chief engineer to any part of the work where the railroad tracks run. In front of the odd radiator on top of the coach may be seen a powerful searchlight, while a similar one is mounted at the rear. This sends its rays to any point that may need special inspection during a night trip.



The "Yellow Devil," Colonel Goethals' private car.

Aerial Divers

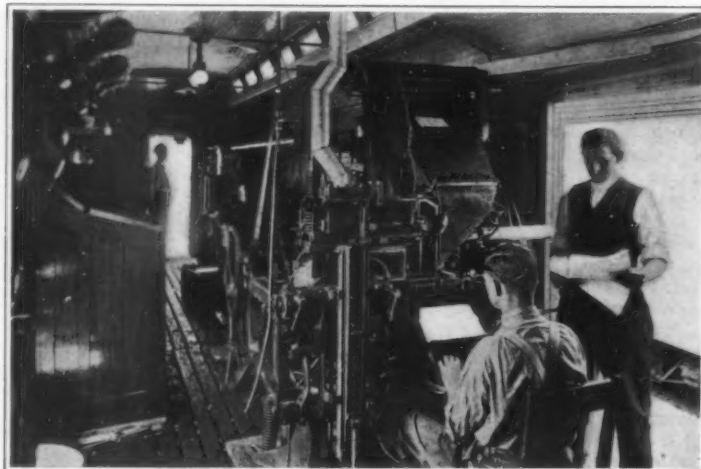
THE highest point on the face of the earth rises 28,002 feet above the sea. This peak of Mount Everest pokes its nose above the life-sustaining stratum of the earth's atmosphere. To reach such an elevation, it is quite as necessary to employ oxygen supplying apparatus as it is for the diver who descends into the sea. The highest point ever reached by man without the aid of special breathing apparatus was 8,000 meters or about 26,200 feet. This was on April 18, 1878 when the balloon "Zénith" left La Villette with three passengers aboard and came down three hours later with two of the passengers, MM. Sidel and Croce Spinelli, suffocated and Gaston Tissandier all but dead. That record for height has just been broken by a wide margin by the balloon "Icare," which, on May 28th of this year, left Lamotte-Beuville, rose to an altitude of over ten thousand meters, or nearly thirty-three thousand feet, coming to the ground five hours later. Two of the passengers, MM. Bienaimé and Jacques Schneider, were photographed by the third passenger, Albert Senouque, at the 10,000 meter elevation. The photograph is reproduced herewith, and it shows the aeronauts well bundled against the extremely cold weather at that altitude and each fitted with an oxygen-breathing apparatus. Each apparatus consisted of a container for 1,600 liters of compressed oxygen, a nose and mouth attachment connected to the container and a means for regulating the feed of oxygen as needed.



Photographed in a balloon 33,000 feet above the level of the sea.

Railway Automobile Newspaper

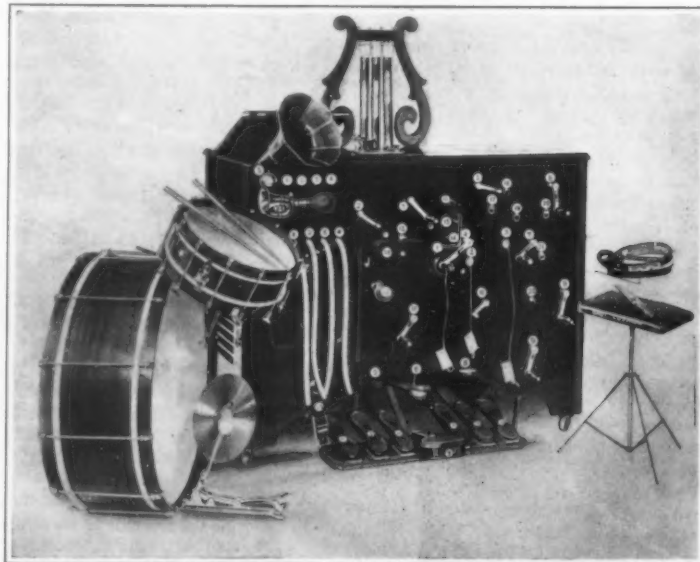
DURING the Glidden tour from Minneapolis, Minn., to Glacier National Park, Montana, July 11th to July 19th, a daily automobile newspaper was printed on the hotel train of the Great Northern Railway, which accompanied the automobile tour to furnish eating and sleeping accommodations for the motorists. The newspaper plant was installed in a dynamo baggage car. The plant included a linotype machine, a cylinder press, and an engraving outfit. The staff photographer's daily story of the tour was told with halftones prepared in the engraving plant. The accompanying photograph shows the "composing room." To run the plant a four horse-power motor was used, which obtained its power from the car dynamo.



Composing room of the railway automobile newspaper plant.

A Noise Orchestra

IN order to add a touch of realism to moving picture exhibitions, it is customary to punctuate the pictures with the noises one would hear if he saw the same scenes in real life. Heretofore this has been done only occasionally and half-heartedly for the reason that many of the sounds called for were difficult to imitate without special apparatus. However, a machine was demonstrated at the recent moving picture exhibition at Grand Central Palace, whereby any number of different lifelike imitations can be produced by merely turning the proper crank or pressing the proper pedal. This stage noise cabinet is the invention of Mr. Samuel Lapin. More than a hundred various sounds can be produced. Not only are all sorts of domestic and wild animal calls produced, but also mechanical sounds. For instance, there are fifteen



Noise orchestra for adding realism to moving picture exhibitions.

different kinds of whistles ranging all the way from the speaking tube whistle to the cuckoo. There are fifteen different bell sounds, ranging from the patrol to the cash register. There are sounds in imitation of the surf, the splashing of water, the rattle of musketry and artillery, the clatter of horses' hoofs over hard ground and over soft ground; thunderstorms, wireless telegraphy; all sorts of machinery sounds, the chug of motor boats, the click of the typewriter, the raising of a latch, the blacksmith's anvil, the washing of dishes, everything in fact from the crash of breaking china to a kiss. In addition to these general noises that may be produced by the machine, it is equipped with musical attachments to produce church-organ music, cathedral chimes, violin music and that of brass instruments, either singly or in a band. The possibilities of this machine are apparently limitless, and should add greatly to the entertainment afforded by the moving picture exhibition.

Egyptian Minerals

ASIDE from its agriculture, attention is being directed to the mineral riches of Egypt, it being naturally asked whether valuable minerals are not to be found beneath the immense desert tracts extending beyond the Nile valley. A leading French authority Prof. Potier treating of this subject refers to the recent discovery of oil fields at Gensah on the coast near the mouth of the Suez Gulf. One sounding operation traversed a 6-inch layer of ozokerite at a depth of 250 feet, and within the last few months the petroleum question is quite active. We may mention the first boat load of 6,000 tons of oil starting from the Red Sea, and new petroleum fields have been lately discovered, it is stated, toward the Sinai region. Turning to copper production, Egypt was rich in this metal in ancient times, but the mines were of such kind as to be easily worked and for this reason are now exhausted. Traces of the copper mines have been found, in which the ore took the form of silicate and carbonate. However, a good vein of silicate is now found on the east coast of Sinai peninsula and other deposits are seen in neighboring places. Manganese deposits are also observed in this region, and good lead and zinc beds as well. Gold is already being taken out at several centers in the extreme south of Egypt, and to the south of Assouan there have been lately taken up the ancient gold mines of the period of the Ptolemies. On the shore of the Red Sea at Sukari quartz having three ounces per ton is now worked. Precious stones are represented by emerald, turquoise and peridot. Phosphates seem to be a more immediate and sure source of wealth for this country, and several beds in the Nile valley show 70 per cent of phosphates. The richest points, however, seem to be at Rachid in the Taklah oasis and at some distance out in the Libyan desert, 350 miles from the Nile valley, but the future extension of the railroad will bring these within reach.

Dutch Dairy Methods

THE most minute precautions are used in the model dairy farms near the large centers in Holland in order to produce milk having the greatest degree of purity, it being designed specially for consumption as fresh milk. Even the kind of food given to the cows and its quality are looked after so as to avoid digestive troubles which are known to affect the quality of the milk. Before milking, the hind parts and udder are carefully washed with boiled water and boric acid, and then the animal is taken to the milking room, this space being washed and disinfected once a day. The milk is collected in special sterilized buckets. In these establishments the personnel undergoes a medical examination to insure their being quite healthy, and they are required to put on a special jacket before the milking, also to wash the hands in sterilized water. In this way the milk is assured to be as free from germs as it is possible to have it.

Inventions New and Interesting

Simple Patent Law ; Patent Office News ; Notes on Trademarks

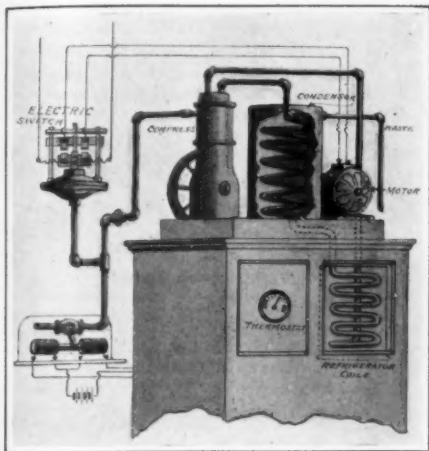


Fig. 1.—Automatically regulated ammonia refrigerating apparatus.

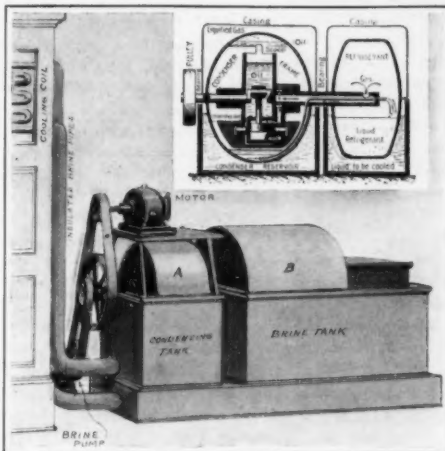


Fig. 2.—Audiffren-Lingrun sulphur dioxide machine.

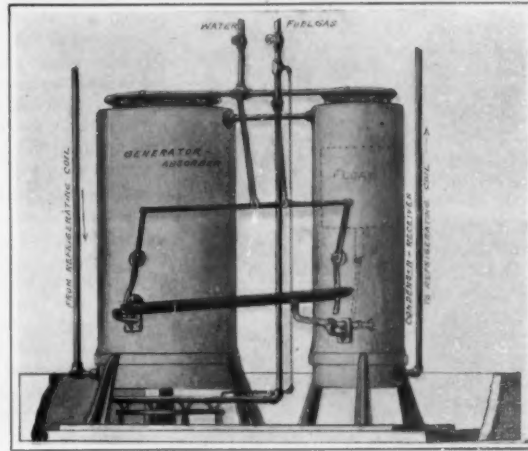


Fig. 3.—Refrigerating machine operated by float-controlled levers.

Refrigerating Machines for the Home

DURING the hot summer months the comfort and happiness of residents in suburban and country places are largely dependent upon the visits of the iceman, and the inventor who is able to produce a small refrigerating machine which will emancipate these people from their abject dependence is sure of his reward. In order to prove a success, such a machine should be as durable and as easily operated as the ordinary home steam heating apparatus. Unless the machine can be safely and efficiently operated by the average household servants it will be impracticable, for the expense of skilled labor would render the use of such a machine prohibitive. Many attempts have been made to produce such a machine, but with varying success, for there are many difficult problems to be overcome in such a device.

For this purpose the compression machine probably affords the greatest promise. In this machine there is a compressor which acts as a pump, drawing in the vapor of the volatile refrigerant on one stroke and compressing it and forcing it into a condenser on the return stroke. Over the condenser cold water is run to take away the heat of the gas due to the compression and also the latent heat given out by the gas when it is converted into a liquid. The liquid refrigerant being under high pressure is forced through the expansion valve into the refrigerating coil or chamber where it evaporates and cools the air or brine in contact with the outer walls of such coil or chamber. As fast as the vapor is given off by the evaporating liquid it is drawn off by the compressor and again forced into the condenser, where it is liquefied. The volatile refrigerants generally used in compression machines are anhydrous ammonia, carbon dioxide or sulphur dioxide, ammonia having the preference. Where ammonia is used the pressure in the condenser must be maintained at about 175 pounds in order that it may liquefy when cooled by water of ordinary temperature. With such pressure the packings of the compressor must be very tight and on a small machine the friction losses are very high. Should the condenser water fail for any length of time, the pressure would rise to a point where some of the pipe connections would be liable to burst and fill the house with acrid fumes of strong ammonia. However, small ammonia machines are coming into very general use in city markets for cooling the large refrigerators employed. They give very satisfactory results, for the handling of the ice and drip water is eliminated and the

temperature can be maintained as low as desired. No skilled attendant is required unless in case of emergency.

Fig. 1 shows a small ammonia machine located on the top of the ordinary refrigerator with the cooling coil located in a brine tank within the refrigerator. Within the refrigerating chamber is a thermostat which, at a certain low temperature, closes and at fixed high temperature opens a valve in the cooling water supply pipe. The pressure of this water, by means of a diaphragm device, closes a switch in the circuit to the electric motor which runs the compressor. Should the water supply be cut off by the thermostatic apparatus or fail for any cause, the lack of pressure under the diaphragm will open the switch and stop the motor. In this way the machine operates only when refrigeration is needed and only when there is an adequate supply of cooling water. Of course, much depends upon the reliability of the automatic apparatus, but there appears to be no inherent difficulty in constructing such devices so that they will perform their function properly if given a little intelligent care and attention.

At first glance it would appear that sulphur dioxide was peculiarly adapted for use as a refrigerant in a home machine, on account of the fact that it liquefies at a very much lower pressure than either ammonia or carbon dioxide; still it has one serious defect when used in the conventional form of compression machine. The suction pressure must be below that of the atmosphere in order that the liquid in the refrigerating coils may evaporate at a sufficiently low temperature to effect refrigeration. With such low pressure air will inevitably leak in, especially through the packings of the compressor, and in time will render the machine inoperative because the air will not liquefy, and therefore its circulation through the machine cannot effect any refrigeration. There is also danger of brine leaking into the system, and when this happens the machine is apt to be seriously damaged, as the water combines with the gas to form sulphurous acid, which is very corrosive. However, two Frenchmen have brought out a sulphur-dioxide machine, shown in Fig. 2, in which these difficulties have been overcome in a very ingenious way. In this machine all moving parts are completely inclosed in hermetically sealed casings, thus preventing any possibility of air leaking into the system. In external appearance this machine resembles a dumb-bell, with an extension on one end for a belt pulley. This structure rotates in bearings in two separate tanks, so that the covered shell B, which serves as the cooler, will be partially immersed in brine,

while the larger shell A, which acts as the condenser, will rotate in cooling water. The two compressor cylinders are made in one heavy piece which is loosely hung on the hollow shaft and the pistons are reciprocated during rotation of the casing by means of eccentrics fixed on the shaft. Ring valves are used to control the suction and discharge.

In operation, the compressors draw off the vapor given off by the liquid sulphur dioxide evaporating in the shell B, compress it and discharge it into the shell A where it is cooled and liquefied and again flows back to the shell B to be evaporated. In case the supply of cooling water fails from any cause, the pressure rises, but before it can become dangerous the pressure overcomes the weight of the compressor cylinders and they rotate with the shell. This means for avoiding high pressure is a very important feature of the machine, for it is infallible in operation and independent of human control. The brine tank may be inclosed in the refrigerator or the cold brine may be pumped through pipes located therein. In case ice is desired it can be obtained by filling small cans with water and placing them in the cold brine.

By actual test it has been shown that these machines are quite efficient and can be run continuously for many years without repairs. As all the moving parts are inclosed the machine is practically "fool proof" and any one with sufficient intelligence to turn on an electric switch and the cooling water can operate it. In case there is a cheap water supply and of sufficient pressure the machine may be operated by a hydraulic motor and the waste water from the motor may be used to cool the condenser. A careful study of this machine will show that it has many excellent features that should make it a success, and it is believed that the prediction is warranted that when home ice machines come into general use, they will be of this type. The original patent on this machine has expired and an attractive field is now open to inventors.

Attempts have been made recently to adapt the absorption machine for home use and such a machine is shown in Fig. 3. In this type of machine a condenser and refrigerating coil are used just as in the compression machine, but in lieu of a compressor a large boiler known as the generator-absorber is used. This boiler is partially filled with strong aqua ammonia and heat is applied to drive off the ammonia in anhydrous condition into the condenser where it liquefies. When practically all of the ammonia has been expelled, the liquid in the boiler is permitted to cool down, and it then readily absorbs the ammonia vapor as fast as it is given

off in the refrigerating coils. In the machine illustrated, the condenser is in the form of an upright tank containing a float. At the end of the heating period this condenser will be nearly full of liquid ammonia and the float in rising will operate a system of levers to cut off the gas to the burner under the generator and divert the flow of cooling water from the condenser to the generator-absorber. At the end of the absorption period the float in descending will again reverse the valves. The success of this machine also depends upon the automatic apparatus properly performing its function.

This Push Button "Talks Back"

IT is reported that a patent has been taken out in Norway and applications filed in England and Germany for an electric push button which when pushed has connected with it devices by which the person whose attention it is desired to attract may respond so that the one signaling knows he has been heard and the one being called is saved the annoyance of listening to repeated ringings. The result is accomplished by an electric magnet provided with a buzzer and the convenience of the improvement appeals especially to those who may be summoned during the night, such as physicians and nurses, and should be found useful in connection with call buttons where those called cannot always immediately respond.

A Novel Electrical Clock

DANIEL DRAWBAUGH, a pioneer electrical inventor, whose activities especially in telephone lines are well known, in the late sixties built a clock which is now running at Carlisle, Pa., in the office of his son, Charles H. Drawbaugh. The clock has continued to operate since 1870, except when being moved from place to place, and operates without winding. The pendulum, weighing forty-five pounds, is operated by an ordinary electro-magnet and a permanent magnet armature, the current in the electro-magnet being reversed as it passes the armature. The battery consists of a plate of copper and another plate of iron, which are buried in the earth. These plates give a small electro-motive force, and enough current to keep the pendulum swinging. A peculiar feature of the clock is the compensated pendulum, which, instead of being in the conventional "grid-iron" form, comprises a pair of brass rods and a pair of steel rods, which connect with each other and with the pendulum bob by means of two short levers, so that the bob of the pendulum will be lifted to just the extent the pendulum lengthens by expansion. It is expected to run 100 years before needing renewal of any parts.

Notes for Inventors

A Sliding Racing Shell Seat.—Adrian Gerardin and Charles Sauve of Pembine, N. D., have secured a patent, No. 1,058,855, for a sliding seat for a racing shell with a spring which draws the seat normally toward the bow of the boat, the seat contacting with an anvil at the completion of its forward movement.

Phonograph With Disk and Cylinder-record Mechanism.—In patent to Adolph Schwer of Buffalo, N. Y., No. 1,058,911, is shown an apparatus in which are combined a phonograph disk-record mechanism and a cylinder-record mechanism together with a driving mechanism which may be clutched to either the disk or the cylinder-record mechanism as desired.

A Coffee Substitute.—John L. Kellogg of Battle Creek, Mich., has patented, No. 1,059,471, a coffee substitute in which there is an admixture of a starchy material and syrup which has been heated and converted into and expanded into a puffed, porous mass browned and pulverized, the starch being dextrinized and the syrup being in the form of caramelized sugar.

An Electric Washing Machine.—In patent No. 1,059,071, for an electric washing machine, issued to Richard D. Robinson of New York city, are included electrodes fed from a source of current supply and means for reversing the polarity of the electrodes. In the use of the invention chlorine is utilized as a bleaching element and the chlorine is produced by the direct action of the current passing between the electrodes.

An Inventor Congressman.—The Official Congressional Directory for the first session of the 63rd Congress, issued April, 1913, contains short biographical notices of the different members of the House and Senate. That of William Henry Wilder, representing the third district of Massachusetts, recites that he was a merchant until 29, manufacturer and inventor, and has had issued to him over 50 patents; also that Mr. Wilder is a lawyer and expert in patent matters. He was elected to the 62nd Congress by 130 and the 63rd Congress by 3,203 plurality.

Five Can-filling Patents.—Walter J. Phelps of Baltimore, Md., assignor of one half to Frank Gebbie of Rochester, N. Y., has secured five patents for can-filling machines or apparatus in which the machines fill the cans through a small perforation of such a size as to prevent spontaneous outflow of liquid therethrough, the small filling opening being also easily closed by a single small drop of solder, the smaller the opening the smaller the drop and less the liability of any of the solder entering the can as a loose globule. The patents include other features and are numbered from 1,058,993 to 1,058,997 inclusive.

A Folding Pistol.—Patent No. 1,059,405 has issued to the Simplex Arms Manufacturing Company, Denver, Colo., as assignee of Horace M. Sprague, also of Denver, for a pistol in which the barrel is hinged to the handle and is adapted to fold against the handle and the spring-actuated hammer in the handle is cocked by the folding of the barrel, a dog being provided for locking the hammer and a two-part trigger being carried by the barrel with the lower member of the trigger engaging and tripping the dog to release the hammer when the upper member is pressed upon.

Cord Feeding and Fastening Tongs.—Patent No. 1,061,165 to William A. Coates of Sidell, Ill., shows a combination cord holder and fastening clencher in which a pincer-like construction has one of its handle bars bored longitudinally to form a passage for a cord run from a ball or spool and the jaws formed to operate clencher devices to secure the cord when passed around a package.

An Early Street-sweeping Machine.—The Washington Star calls attention to an early experience in street cleaning in the national capital and quotes from its issue of February 10th, 1863, fifty years ago, telling how Mr. Critchenson, proprietor of the patent street-sweeping machine which bore his name and was then in use in

Broadway, New York city, undertook the sweeping of the avenue. At that time the condition of Pennsylvania Avenue, the national parade ground, was such that Mr. Critchenson had to put about one hundred laborers to work cleaning off the nearly foot deep mud before the operation of the sweeping machine.

A Collier With Two Hulls.—A collier formed with two spaced apart side portions so arranged as to receive between them the ship to be coaled and having a bow portion connecting the side portions and delivery pipes for directing the coal from the side portions into the ship between them, is shown in a patent, No. 1,059,201, to Charles Pacquier of New York city.

Two Nikola Tesla Patents.—Tesla has secured two patents, No. 1,061,142, for a rotary pump, and the other, No. 1,061,206, for a turbine, both of which include suitable casings with inlet and outlet ports and a plurality of plane surfaces spaced apart. The inventions have already been described at length in the columns of the SCIENTIFIC AMERICAN.

Show Window and Show Case Improvement.—Patent No. 1,060,787 to Tron O. Peterson, of New York city, assignor to Store Improvement Company, Inc., of New York, is for an apparatus such as a store window or show case for exhibiting merchandise which has a transparent partition and an opaque partition in front of the transparent partition and extending vertically partly across it, the idea being to remove the reflection in the glass of the store window or show case of objects in front of the glass so that the attention of the observer is not attracted from the article in the window.

A Holder for Gas Mantles.—In patent No. 1,059,978, John Cartwright of Cleveland, O., shows a device for attaching and removing gas mantles which has a cylindrical shell with recesses in its upper edge to receive the arms of an inverted gas mantle so the cylindrical shell can be easily connected with the mantle and cause the mantle to be rotated, a handle being suitably connected to the shell.

Converting a Business Coat Into a Dinner Coat.—Isidor Kaiser of Baltimore, Md., has patented, No. 1,059,542, means by which a business or sack coat can be converted into a dinner coat or Tuxedo, including lapel covers with means whereby they may be conveniently and detachably secured in effecting the conversion of the garment.

A Fessenden Improvement.—In patent No. 1,059,665 Reginald A. Fessenden of Washington, D. C., assignor to Samuel M. Kintner and Halsey M. Barrett, has patented a wireless apparatus in which there is combined with an antenna and an operating instrument, several complementary conductors and means for altering the capacity of the antenna by employing the influence of different ones of the conductors. Patent No. 1,059,666, same inventor and assignees, provides for preventing interference by the aid of two antenna-ground circuits each containing the primary of a transformer with a receiver circuit connected through the secondaries to both of the transformers and a phase-adjusting device connected to the antenna-ground circuits.

Internal Combustion Engine with Delayed Ignition.—Patent No. 1,054,080 has been granted to G. A. Bachmann of Baltimore, Md., on an internal combustion engine in which the time of combustion or the moment when the pressure on the piston is greatest is deferred until the lever of the crank is in the position of its greatest efficiency. This is done by using as the main gaseous supply a mixture of hydro-carbon and air in which the proportion of air is less than that necessary to produce complete combustion when the mixture is ignited, and reinforcing this compressed mixture at the time of its greatest compression with atmospheric air at a still higher tension; admission of the air is continued until the piston has passed through a predetermined fractional part

of its stroke, when the influx is suspended and the gases are ignited. The power expended in compressing the air in the reservoir is nearly all returned in work performed by the piston in the cylinder before the explosion of the combustible mixture of gases.

Trade-mark Notes

Oneida Community Trade-mark.—In the trade-mark case *ex parte* Oneida Community, Limited, the Commissioner of Patents has held in affirming the decision of the Examiner of Trade-marks refusing to register a certain trade-mark, that when a patent showing a certain construction expires, the public has a right to manufacture articles in accordance therewith, and that right cannot be taken away under the guise of a registration of a trade-mark. The trade-mark in question was described as "the raised, substantially circular or O-shaped film, having distinct edges appearing on the back of the spoon bowl," and the refusal of the Examiner of Trade-marks to register the mark was based on the ground that the mark is not a distinct mark of origin and ownership, and he cited several patents to show it to be common to place a film of metal on the back of the bowl of a spoon.

Trade-mark Opposition in Relation to Unfair Competition.—In a recent case of *Oliver Chilled Plow Works v. The William J. Oliver Manufacturing Company*, the Court of Appeals of the District of Columbia refers to a timely criticism in the decision of the Examiner of Interferences of much of the evidence appearing in the record as follows: "There is a great mass of testimony in this case which is entirely irrelevant to the questions which this tribunal is called upon to decide. The record is full of matter which relates solely to the question of unfair competition in trade, which matter it has been repeatedly held cannot be considered in a trade-mark opposition. The only question for consideration here is whether or not applicant is entitled to register his mark."

A Large Judgment in Unfair Competition Case.—The announcement that a judgment of \$445,311.85 has been awarded one shoe manufacturing company against another such company in the middle West as representing the profits made by the defending company on a certain shoe since 1906 emphasizes the value and importance of trade-marks and trade names in the commercial world. Not many years ago an attorney from the Northwest, representing a twenty million dollar company, was at Washington for his company in a patent interference suit, and seeking to derogate from the value of patents said: "Now if any one was to attempt to infringe any of our trade-marks my company would spend a million dollars in defending it," as the business of the company was largely founded on the value of its trade-mark properties. That it also valued patent rights was established in the same case by the purchase by the company of the patent of its opponent in the patent interference suit referred to, which purchase was concluded shortly after the remark before quoted.

Changes in German Patent and Trade-mark Law.—German consuls and commercial agents call attention to a new German law of March 31st, 1913, making alterations in the patent and trade-mark laws and providing that citizens of the German empire may now claim the benefit of the laws for the protection of utility models, and trade-marks under the law of unfair competition, even though such German citizens may not have a residence or establishment in Germany. A feature of the new law, which feature is a distinct innovation, provides for the registration of trade-marks by associations, the new form of trade-mark being called an "association trade-mark," which may be registered by associations of manufacturers or merchants for exclusive use in connection

with the goods of the members of the association. These marks are said to be of considerable importance in Austria-Hungary and some other countries. Heretofore there has been no provision for them in the German laws. These trade-marks may be entered, according to the new law, by associations having a legal existence and interested in trade, even if they are not producers or purveyors of goods. The new law should be of interest to citizens of Germany residing in this country and needing the protection of their trade-marks under the German law.

Legal Notes

The Court of Appeals on Patentability.—In *ex parte* Harbeck, the Court of Appeals of the District of Columbia, in reversing the decision of the Commissioner of Patents and granting the patent, took occasion to discuss the patentability of the invention. In referring to the Commissioner's rejection on the ground that it would not require invention, the Court said:

"It is easy to dispose of a case where the issue of invention is close by holding that the advance over the prior art constitutes a mere mechanical change apparent to those skilled in the art. But in the absence of proof to support this conclusion, and where the question of patentability is close, the doubt should be resolved in favor of the applicant."

The Court also said:

"While the use of new materials to produce a known result, or of known materials to produce a new but obvious result, may not always constitute invention, if the new idea, when applied, brings success out of failure, produces a new and useful result and saving in operation or production, or efficiency instead of inefficiency, gives to the device new functions and useful properties, it is invention, and may be patented. . . . In other words, the inventive discovery made by appellant consisted in an intelligent apprehension of the elements entering into the device and the bringing of them together in such a relation as to produce a new and useful article of commerce. The extent to which he modified or altered existing inventions is unimportant, since he accomplished a new and beneficial result not so obvious as to suggest itself to those skilled in the art. It remained for appellant to discover the hidden cause that marked the line between failure and success."

Process and Apparatus.—In *Moulton and Jones* the Court of Appeals of the District of Columbia, in affirming the decision of the Commissioner of Patents, has said: "It is true, of course, that a process and an apparatus or mechanism by which it may be performed may constitute separate inventions. It is also true as contended by the appellants, that a process is not anticipated by a prior mechanism by which, with some alterations, it might have been performed. It is not only necessary that the prior patents might have been used to carry out the process, but that such use was either contemplated or would have occurred in the ordinary mechanical operation of the device." Also in referring to the putting in operation of a natural law without fully understanding or appreciating the principle or theory of that operation, the Court of Appeals said such person "was entitled to all the direct uses of his invention."

Patent Adjudications.—The Cowles patent, No. 319,795, for process of smelting by an electric current, has been held infringing in *Carborundum Company v. Electric Smelting and Aluminum Company*; Thropp patent, No. 822,561, for apparatus for manufacturing automobile tires has been held void for anticipation in *DeLaski & Thropp Circular Woven Tire Company v. Fisk Rubber Company*, while the Harroun patent, No. 873,544, for an automobile bumper was held valid and infringing in *Turner Brass Works v. Appliance Manufacturing Company*. In *Palmer v. Superior Manufacturing Company* the Palmer patent, No. 878,995, for apparatus for inverting tubular fabrics was held not so clearly infringed by a machine used by the defendant as to warrant the granting of a preliminary injunction. The Sager patent, No. 885,181, for an automobile buffer was held void for lack of invention in view of the prior art in *J. H. Sager Company v. Emil Grossman Company*.

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel.

DETACHABLE CUFF.—L. D. LIVINGSTON, care of Livingston & Lieberman, 547 Broadway, N. Y., N. Y. This cuff is arranged to permit the wearer to conveniently attach it to the sleeve of shirts, waists and similar garments or remove it therefrom, and to give it the appearance when attached of being sewed on or forming an integral part of the sleeve.

HAT STRETCHER.—K. WICKERSHEIM, 244 E. 52nd St., Manhattan, N. Y., N. Y. This inventor provides a stretcher more particularly designed for use in hat stores to permit of conveniently and quickly stretching a hat, either all around or only at the sides, or at the front and back to insure proper fitting of the hat on the wearer's head.

Pertaining to Aviation.

AEROPLANE.—E. P. VINCENT, P. O. Box 415, West End, N. J. The object here is to provide an aeroplane having a strong frame of light construction on which are mounted to rotate on vertical axes two planes, which are spaced apart, means being provided for propelling the aeroplane and for rotating the planes.

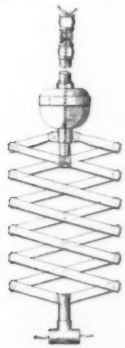
Electrical Devices.

TROLLEY REPLACER.—G. A. SPAETH, care of Downs Schaaf, 1877 Summit St., Columbus, Ohio. In the present patent the invention relates particularly to over-head trolleys, and the purpose of the improvement is to provide a replacer device to guide and replace the trolley wheel on the conductor wire.

BURGLAR ALARM.—G. A. BREWSTER, 3 S. Elliott Place, Brooklyn, N. Y. The object here is to provide an alarm adapted for temporary installation on the knob of doors and in conjunction with the keys for locking same. With this in view the inventor provides an attachment quickly and readily installed upon a door knob or other rotary closure device employed for opening doors or windows.

SANITARY TELEPHONE ATTACHMENT.—G. W. DOWNS, 215 W. 4th St., Manhattan, N. Y., N. Y. This invention relates to telephony and particularly refers to means for safeguarding a user of an ordinary telephone from infection or disease which is likely to be transmitted to his lips by contact with a public telephone mouthpiece.

EXTENSIBLE ELECTRIC LIGHT FIXTURE.—F. GARRECHT, Idaho City, Idaho. The invention refers particularly to suspended electric light fixtures, and the objects are to provide a fixture in which the electric lights are suspended and counterbalanced in a novel manner; to provide for the easy adjustment of the



EXTENSIBLE ELECTRIC LIGHT FIXTURE.

lights to a higher or lower position; to provide for housing and concealing the wires in the extensible elements; and to provide a fixture in which elements are adapted to be produced in ornamental form.

Of Interest to Farmers.

POWDERED MOLASSES FOOD AND PROCESS OF PRODUCING THE SAME.—LA F. MYERS and A. A. CARRICK, Glendale, Ariz. Address the former. An object here is to provide for producing a powdered molasses which may be easily handled and transported and which will keep indefinitely until such time as it is desired to again bring it to a liquid state by the addition of water to be used in feeding cattle.

HUMANE ANIMAL POKE.—W. E. BAKER, R. F. D. No. 3, Crescent, Oklahoma. An object of this invention is to provide a poke which will prevent an animal from endeavoring to force fences, without resulting in injury to the animal. An animal may wear the poke without creating sores and without annoyance or inconvenience.

FLOW AND CULTIVATOR.—J. M. RIVERS, P. O. Box 234, Fort Meade, Fla. This implement is particularly for use in furrowing between rows of crops. It comprises a beam, a standard formed of two bars arranged parallel and secured together, a mold-board, and a

landside having its enlarged head constructed with sockets in the opposite sides, to receive ends of the standard bars and a bolt passing through both landside and standard.

FLOOD GATE.—A. S. GALBRAITH, Baxter Co., Ark. The invention illustrated herewith is an improvement in flood gates, and it provides a simple, inexpensive device composed of separable units, and capable of being increased

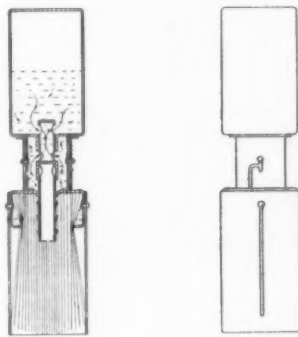


FLOOD GATE.

or decreased in length for streams of different sizes, normally in erect position to prevent the passage of live stock, but capable of swinging out of position to permit the passage of drift, and automatically returned to position after the passage of the drift.

Of General Interest.

SHAVING BRUSH.—E. T. KREBS, Carson City, Nev. One object here is to provide a measuring chamber which, in the normal position of the parts, is registered with the reservoir chamber and is filled thereby, and which when registered with the brush to deliver its



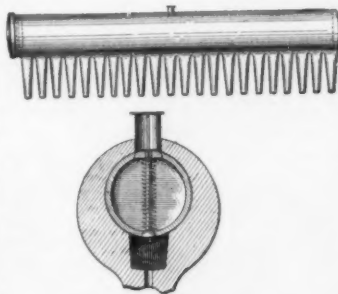
SHAVING BRUSH.

contents thereto, is cut off from the reservoir chamber so that at each operation the brush receives a measured supply of liquid. A further object is to provide a shield for the brush proper, which is slidable to and from an operative position, in place of the detachable cap or hood usually employed.

PROCESS OF MANUFACTURING ALLOYS.—L. WEISS, Berlin-Charlottenburg, Germany. The essential feature of the process consists in intimately mixing the constituent parts, the two or more metals which have to be united for forming the alloy to be obtained in the cold state, one of such parts or metals being in the form of fine chips or of a coarse powder, while the other of the alloy to be formed, that is, the other metal or mixture of metals to be united with the first named coarsely comminuted constituent or metal for forming the alloy, is in the form of fine powder.

LID OPERATING DEVICE FOR CABINETS OR THE LIKE.—G. A. SCHWARTZ and A. C. BARCOCK, Bessemer, Ala. Address J. M. Dudley, same place. This device is for use particularly in connection with cabinets for containing tubs, barrels or the like in stores. Many packages contain unsightly and unsanitary articles. The inventor provides a cabinet for containing such a package, with a lid operated by a treadle so that it may be closed by the foot of the clerk or operator, leaving his hands free for other purposes.

SCALP TONIC COMB.—A. E. LAMBERT, care of Powder Valley State Bank, North Powder, Ore. This invention relates to improvements in that class of combs which are provided with a hollow chamber and hollow teeth adapted to receive and convey a liquid such as a tonic directly to the scalp. The present comb com-



SCALP TONIC COMB.

prises a hollow body provided with a series of hollow radial teeth, and an opening in its upper side, a liquid receptacle fitted in the body and having aligned top and bottom openings registering with the first named opening. One engraving shows a cross section of the article, and involving the center tooth of the comb at the top of which is seated the press button which opens the liquid valve and the upper valve in the cylinder.

APPLIANCE FOR MAKING FLASH-LIGHT PHOTOGRAPHS.—L. D. LITTLE, care of Schmid Chemical Co., Jackson, Mich. The invention has in view a cabinet having a screen of white muslin or similar material at the front and adapted to be supported in a horizontal position directly over the front board of the camera, whereby the shadows around the figures are to a considerable extent eliminated and a clear, natural picture produced.

CORNER PIECE.—S. V. DUFFY, 446 75th St., Brooklyn, N. Y. This invention relates to improvements in corner pieces or plates, and the purpose is to provide a construction which will bind the various blocks forming the corner properly together and also provide openings through which bonding mortar may project.

CIGAR AND CIGARETTE HOLDER.—J. V. FERNANDEZ, Camaguey, Cuba. The invention relates generally to cigar and cigarette holders and more particularly it involves a construction wherein the holder is provided with automatic means for ejecting the butt of the cigar



CIGAR AND CIGARETTE HOLDER.

or cigarette. It provides a holder with means whereby the butt may be ejected from the holder when desired. The case co-acts with the holder, whereby the insertion of the latter into its case will cause the ejecting means to be brought into operative position for use. Means provide for using the cigar without biting off the end previous to smoking. A chamber provided with a filter arrests the smoke before reaching the mouth.

SURGICAL APPLIANCE.—L. E. WOODWARD, 1322 Franklin St., Waco, Tex. The inventor provides an appliance especially adapted for the treatment of rectal and uterine troubles, wherein a means is provided for supporting the parts, while at the same time applying healing medicaments, and a means of preventing protrusions, both mounted on a common support. The support prevents discomfort to the wearer and is sufficiently firm and rigid.

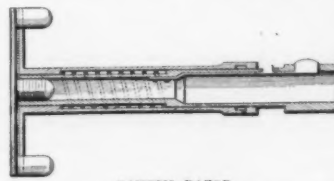
Hardware and Tools.

WINDOW LOCK.—L. VOGGENREITER, 496 W. 130th St., New York, N. Y. The principal object here is to provide a window lock made up of parts carried by the casing and by the upper and lower sash, whereby the window may be left open a certain amount, the construction being such that the lock is not easily disturbed.

MATCH HOLDER.—J. F. O'MALLEY, 143 W. 127th St., New York, N. Y. The holder is especially designed for holding a bunch of tapers or wooden matches concealed and protected while not in use, to allow convenient removal of a match whenever desired, and to permit quick refilling of the holder with a bunch of matches.

FILE.—O. G. SIMMONS, 2047 Ontario St., Tioga, Philadelphia, Pa. This invention refers to metal working tools and has particular reference to an improved manner of cutting edged tools such as files whereby the latter are more rapid in cutting operation and more durable than files heretofore constructed.

SAFETY RAZOR.—L. J. FAY, Nogales, Ariz. This razor comprises a blade holder, a tubular blade compressor for use in pressing a blade against the holder and a safety shield separate from the compressor and having guard devices, the shield being movable relatively to the compressor and from the blade holder.



SAFETY RAZOR.

In use, if the beard is heavy the first time over it may be shaved with the shield raised, and then lowered for the final or close shaving, or the razor may be used with the shield entirely removed, thus forming an ordinary or open razor. The blade may be double edged and will be wedge-shape or convex surfaced on both sides.

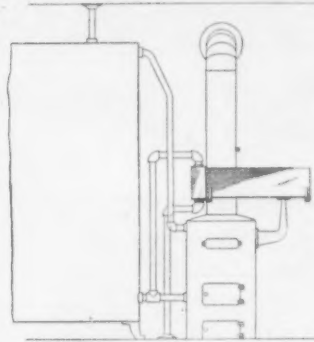
Heating and Lighting.

INVERTED INCANDESCENT GAS LAMP.—W. GORLITZER, Vienna, Austria-Hungary. Numerous objections to features of the inverted incandescent gas lamp are remedied and at a reduction of expense by the present invention, according to which by a single manipulation of the projecting cage all the parts of the lamp that require cleaning and changing may be removed as an entirety.

MECHANICAL STOKER.—G. B. CRAMP, 808 Wolvin Bldg., Duluth, Minn. Means are here provided for passing fuel through the furnace at a speed that will permit the fuel to be consumed, and means is also provided in connection with the feeding means for breaking

up and separating the burning fuel as it travels, to permit the greatest possible amount to be converted into heat, and to prevent formation of clinkers and the adherence of fuel and waste products to the grate bars.

HOT WATER HEATER.—G. REICHARD, 87 Hamilton Place, New York, N. Y. The invention relates to heaters such as used in apartment houses, hotels and other places for supplying apartments or rooms with hot water. The heater is provided with a preliminary hot water heater to insure quick heating of the



HOT WATER HEATER.

water even in case a large amount is used in a given time, and the waste gases of the hot water heater are utilized to heat the feed water thereof by the preliminary heater, thus requiring comparatively little fuel for quickly heating the water to the desired degree.

Household Utilities.

ATTACHMENT FOR COOKING UTENSILS.—C. GRAY, 723 So. 2nd St., Plainfield, N. J. This attachment is particularly for use with kettles, pots and the like provided with balls, and the invention provides a guard attachable to the ball of any utensil indicated, to constitute a shield to prevent steam from rising around the handle of the utensil when its cover is removed.

BED.—T. H. SORLIEN, Granite Falls, Minn. This bed may be hoisted or elevated to the ceiling of a room so that it will not take up any floor space, there being an arrangement wherein the bed enters an opening in the ceiling and is so constructed that, with the decorations of the ceiling and the bed conforming to each other, the presence of the bed in disuse will ordinarily pass unnoticed.

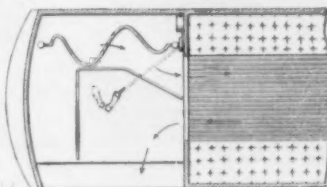
SUSPENDED CLOTHES RACK.—B. B. BOSWORTH, 473 W. 145th St., New York, N. Y. This rack is capable of reliable, direct attachment to a lath and plaster ceiling without reference to the invisible beams to which the ceiling is affixed, capable of retaining the parts of this collapsible rack in proper conjunction with one another by automatic constraint of the suspended harness and without other fastenings, and capable of being easily adjusted and retained at any height and in horizontal position.

BOWL AND CANISTER.—J. S. DESMARAI, 129 3rd St., Union Course, L. I., N. Y. The invention is designed for use in distributing sugar, coffee and other similar articles, and has for an object to provide an improved structure wherein measured quantities will be dispensed upon each inverting of the bowl or canister.

Machines and Mechanical Devices.

CLUTCH.—E. J. SWEET, Tampa, Fla. The invention relates to clutches, especially those designed for use in automobiles. An object is to provide a clutch having detachable bearing members which may be quickly removed and replaced when worn. The clutch will automatically free itself when force is applied to cause release of engaging members.

PASSENGER COUNTING DEVICE.—M. H. CHAMPTON, 75 Fulton St., New York, N. Y. This improvement relates particularly to a structure which will permit ready entrance and exit and count only the persons entering. The object in view is to provide a counting device



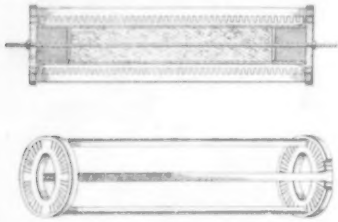
PASSENGER COUNTING DEVICE.

for street cars, theaters and the like, which will permit the ready entrance and exit of persons in a continuous stream, but counting only the persons entering. The device is well designed to take the place of the ordinary turnstile now in use. A top view of the device shown on a car, the car being shown in section, illustrates the invention.

GUMMING AND FILING MACHINE.—A. L. KIRKWOOD, Blocker, Tex. Means here provide for holding a circular saw in position on

a frame, there being an emery or other sharpening wheel revolvably and adjustably mounted on the frame, the arrangement being such that the wheel when revolving will engage in one of the teeth of the saw only at or above a certain speed. Means provide for moving the saw in order to bring each tooth into successive engagement with the sharpening wheel. Means also provide for dressing the sides of each tooth after the wheel has done its work.

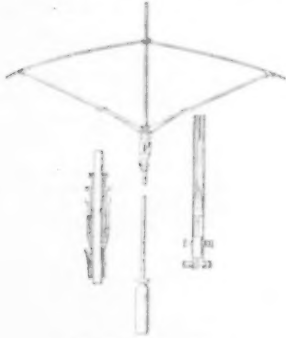
OZONE PRODUCING MACHINE.—D. C. SMITH and F. M. HUMMEL, Des Moines, Iowa. An object of the invention is to provide a device in which a maximum amount of ozone may be produced with a minimum expenditure of energy. The device may be readily as-



OZONE PRODUCING MACHINE.

sembled and taken apart for the purposes of cleaning or inspection. Means provide for centering the discharge terminals, so that the latter may be at once brought into their proper position. In this device the air is brought under the immediate influence of an electric glow, and the result is an ozone of exceeding purity.

FOLDING UMBRELLA.—A. SALOF, 125 Franklin Ave., Oakland, Cal. In this case the purpose is to provide a simple, inexpensive, easily operated device wherein a frame is provided, consisting of a sectional stick and means for holding the sections of the stick in

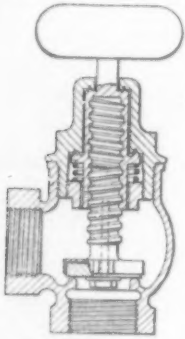


FOLDING UMBRELLA.

rigid alignment, folding ribs having stretchers, and folding braces, together with a locking mechanism for the stretchers, operated by the braces, and a locking mechanism for the braces operated by the runner.

ADJUSTABLE FEED OIL RING.—C. W. EISENMANN, 2838 W. 26th St., Chicago, Ill. This ring feeding mechanism conveys oil to a shaft bearing, and regulates the amount of oil to be fed to the shaft. By means of this device the flow of oil is automatically stopped when the parts become congested, due to a rapid feed of oil.

PACKLESS VALVE.—H. M. ARTZ, Mansfield, and E. B. LORENZEN, Sandusky, Ohio. Address: H. T. Manner, attorney, 1035 Diamond St., Mansfield, Ohio. The present invention relates to valves, and the particular object is to provide one which may be opened and closed in a manner similar to that of the



PACKLESS VALVE.

ordinary valve and which will dispense with the necessity of packing and the gland usually surrounding the valve stem in reciprocating valves. The engraving shows a vertical section through the valve body, the bonnet and the handle stem.

ATTACHMENT FOR WINDMILLS.—L. R. BURLISON, Box 607, Big Spring, Tex. Mr. Burlison's invention relates to attachments for windmills of that type embodying crank disks or face plates for the purpose of converting rotary motion of the wheel shaft into reciprocating motion for actuating the pitman of the sucker rod.

MACHINE FOR REMOVING PULP FROM COFFEE BEANS.—J. M. URGELLE, Sao Paulo, Brazil, S. A. This machine removes pulp from coffee beans in a very simple, effective and economical manner and without injury to the coffee beans. The pulp passes readily into hollow separators and conveyors to be thrown out of the same at the outer edge by centrifugal force while the machine is running.

JETTING ATTACHMENT.—A. N. KETTERER, care of Automatic Jetter Co., 6th and Albemarle Sts., St. Joseph, Mo. The object of the present patent is to provide a jetting attachment which can be easily attached to the discharge chute of beer bottle fillers whereby jets of beer may be directed successively into a number of bottles whereby the beer therein may be agitated in order to expel the air therefrom.

STAMP AFFIXING MACHINE.—J. W. NEARY, care of Clarence Reed, care of Natural Carbonic Gas Co., McClellan St. and Frelinghuysen Ave., Newark, N. J. This invention provides against accidentally severing a stamp or label but at the proper point or removing stamps from the machine without authority, except to affix them to mail matter; furnishes moisture to the stamp without wetting to excess; provides for cutting at the required point; provides means whereby the stamp is applied at uniform distance from the top and constructs means to enable the operator to work it on any height desk.

GOPHER TRAP.—A. F. RENKEN, Kramer, Neb. The trap is substantially rectangular and arranged with trip mechanism an appreciable distance from the end designed to catch the animal, so that the animal engaging the end may be placed into a hole or other place so as to prevent the animal from escaping without passing through the trap.

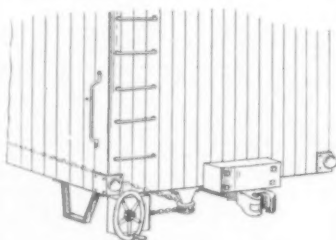
Prime Movers and Their Accessories.

ROTARY ENGINE.—J. F. NETTLE, Silverbow, Butte, Mont. This invention has for its object to provide a rotary engine with matted wire members, which are referred to as wire wool, the wire members fitting snugly against the casings in which the cylindrical member is disposed for rotating.

HEATER FOR INJECTORS.—H. E. HASKELL, 1634 Sixth Ave., Huntington, West Va. In the present invention the improvement has reference to injectors, and it has for its purpose the provision of a heater which will automatically heat the injector, when it is not in use, thereby preventing any freezing in the pipes.

Railways and Their Accessories.

CAR BRAKE.—C. E. ROCHAMBEAU, 2613 So. 18th St., St. Joseph, Mo. This invention relates to railway rolling stock and has particular reference to a form of hand operated brake for freight cars or the like, whereby the brakeman will have better control of a car, especially in a switch yard where the cars are being handled in detached relation to the engine, than has heretofore been possible with



CAR BRAKE FOR FREIGHT CARS.

ordinary forms of brakes. The brake or set of brake mechanisms can keep a car under practically perfect control of the brakeman when operated either from the bottom of the car as shown in the engraving or from the opposite end at the top where it is customary to locate a brake on a box car. The brakeman can operate it freely by one hand, while hanging upon the car with his feet and the other hand and irrespective of the load on the same or adjacent car.

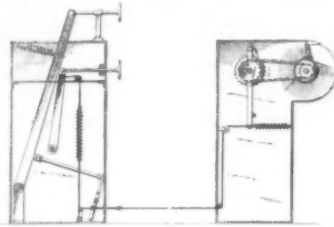
CAR DOOR LOCK.—J. B. DRISCOLL, 26 Church St., Clifton Forge, Va. This inventor provides a double locking means operated by pressure from the air brake system, so arranged that when the car is set out on the siding, the lock belonging thereto is so arranged that the car contents cannot be tampered with without breaking the lock and wherein while the car is in the train, the lock may be operated to release the door by authorized persons.

Pertaining to Recreation.

FISH HOOK.—L. J. ENGLUND, Marshfield, Ore. The invention refers to the class of fishing devices comprising a plurality of hooks having means for retaining them in close relation, and adapted to be released and to spring apart when the bait carried thereby is taken hold of by the fish.

GAME APPARATUS.—H. W. HELLIKER, 1271 Tenth St., Oakland, Cal. This apparatus will have peculiar attractiveness for players given to the operation of gaming devices which involve more or less physical exercise and

which are attractive also because of the elements of chance involved. A casing supports a series of targets arranged in a horizontal row, and are adapted to be thrown at from a distance of, say thirty to fifty feet, and struck by balls thrown by players, there being



GAME APPARATUS.

provided at any convenient place, preferably adjacent the players' position, an indicator adapted to operate in accordance with the target struck.

Pertaining to Vehicles.

VEHICLE SIGN.—V. L. WALLACE, care of Warm Springs Co., Barber Shop, Salt Lake City, Utah. In this invention the object is the provision of a new and improved sign for use on automobiles and other vehicles so as to display the characters to their full extent and to insure proper illumination of the sign during the night.

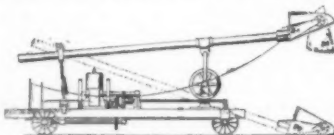
SIGNAL DEVICE.—C. F. MARSTON, Box 113, Cedarhurst, L. I., N. Y. In the present patent the invention has reference generally to signal devices and more particularly it involves an improved structure for use on automobiles whereby the driver may notify drivers of following vehicles of movements about to be made.

LAMP ATTACHMENT FOR AUTOMOBILES.—R. S. MATHESON, Arroyo, Island of Masbati, Philippine Islands. The improvement is in lamp attachments for automobiles and particularly in lamps designed to turn automatically and light up the road while rounding curves. When the steering gear is operated to turn the machine in one direction or the other, the lamp will be correspondingly turned to throw the light in the direction of the curve.

RESILIENT VEHICLE RUNNING GEAR.—W. H. BROWNING, 16 Cooper Square, New York, N. Y. The invention provides means for mounting vehicle wheels to permit them to avoid shocks or sudden lift thereof without transmitting the shock or lift to the body of the vehicle; and provides a mounting for the vehicle, which will accommodate itself readily to road inequalities and prevent too rapid return or oscillation of the wheel and parts connected therewith.

AUTOMOBILE HORN.—N. C. ODDO, 116 North St., Middletown, N. Y. The intention in this invention is to provide an inexpensive device for producing a warning sound, capable of attachment to any automobile, and in any desired position, which may be operated from a distance or at hand, as may be desired. Mr. Oddo has also invented an automobile horn the object of whose improvement is the provision of mechanism for imitating a series of rapidly succeeding air vibrations, together with mechanism for controlling and modulating the vibrations to produce sound waves resembling the human voice as modulated by the lips.

POWER SHOVEL.—A. OFFERMANN, 435 W. 8th St., Davenport, Iowa. This invention relates more particularly to power shovels mounted on a wheeled truck or carriage, and having means for raising and lowering the shovel and dumping the scoop forming part of



POWER SHOVEL.

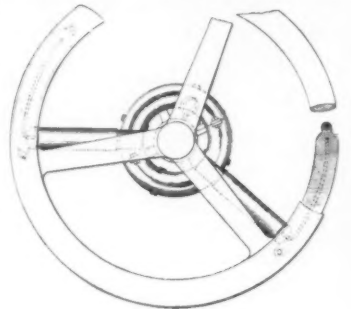
the shovel. The invention comprises a long arm or lever, on the forward end of which a scoop is mounted, the lever being swiveled in a block or socket mounted on a crank-shaft, the lever and scoop having suitable controlling devices, and means being provided to turn the crank-shaft to raise and lower the shovel, and means to propel the truck on which the shovel is carried.

POWER DUMPING WAGON.—J. P. POWERS, Ossining, N. Y. The inventor provides a wagon for carrying garbage, refuse, ashes, coal and other materials, which is arranged to utilize the motive power for propelling the wagon and for moving the body thereof from loading into dumping position and vice versa to permit convenient loading of the body when in normal horizontal position to insure complete discharge of contents when the wagon body is in dumping position.

FOLDING JACK TRUCK MECHANISM.—E. G. QUICKEL and A. E. QUICKEL, York, Pa. Address: E. G. Quickel, York, Pa., care of the Spangler Mfg. Co. This invention is to be employed for supporting the weight of the vehicle in order that injury to the tires may be

reduced to a minimum during the time while the tires are not actively in use, and especially while the vehicle is resting idly in a garage.

HAND GRIP.—A. YOUNGS, 249 Grand St., Newburgh, N. Y. The invention provides a heating system to warm the hands of a steersman or operator of a motor or other driven



HAND GRIP.

vehicle where the controlling devices are in exposed positions; provides an attachment for heating the hands under the above conditions, which may be removed and replaced at will from or upon the controlling device; and provides an attachment adapted for installation upon standard controlling devices.

WHEEL.—S. BROWN, 40 Whitcross St., London, England. An object here is to provide a wheel for use on vehicles, whereby it may attain all the advantages of a pneumatic or cushion type wheel without the disadvantages thereof. Another object is to provide a wheel for absorbing shocks from uneven roads, or obstructions on the same.

AUTOTRUCK BODY.—J. N. BREWSTER, 2825 W. 2nd St., Coney Island, N. Y., N. Y. This invention relates to cart or wagon bodies and comprises a construction especially adapted for use in coal cart bodies for auto trucks. In structures of this kind it is essential that they be light in weight, strong, and shall afford as free access as possible to the machinery of the chassis carrying the body.

Designs.

DESIGN FOR A JAR.—D. C. JENKINS, Glass Co., Kokomo, Ind. This new design for a jar has for its most ornamental feature a spiraled top for the lid. The jar is simple, but graceful in outline.

DESIGN FOR A PLATE OR SIMILAR ARTICLE.—E. BOOTE, East Orange, N. J. The plate is circular and its ornamental feature comprises a design at four equidistant points of a somewhat strong and very effective pattern.

DESIGN FOR A COMBINED STAND AND RACK.—C. DE YOOS, Brooklyn, N. Y. In this ornamental design the base holds a baseball, and a games box. The stand comprises the bats at the handles of which a calendar is strapped and over the ends of the bats a round clock is seated.

DESIGN FOR A CARPET OR RUG.—W. E. SAYERS, Thompsonville, Conn. In this design, No. 44,260, the rug has a broad border of several bands of marked variety. A square centerpiece occupies the field, the latter designed with a profusion of leaves. Mr. Sayers has designed another carpet or rug, No. 44,261, with a border of several bands. The centerpiece is a highly ornamental pattern in a field of simple composition with flower clusters in the corners.

DESIGN FOR A CARPET OR RUG.—H. A. HOWE, Thompsonville, Conn. In this design the border comprises three bands of different patterns. The field is solidly covered with ornamental work up to an intricate and handsomely created centerpiece.

DESIGN FOR CARPET OR RUG.—H. A. HOWE, Thompsonville, Conn. This ornamental design for a rug has a border and field of subdued rather than of pronounced features, the whole showing a uniformly pleasing effect.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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Inquiry No. 9304. Wanted the names and addresses of manufacturers of a second hand bag cleaning machine on the order of a carpet cleaning machine.

Inquiry No. 9305. Wanted the name and address of concerns making paper letters and figures.

Inquiry No. 9306. Wanted small hardware and other specialties to be sold in notion and grocery stores. Wanted to buy wholesale.

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Inquiry No. 9309. Wanted to buy small woven tubing of small diameter for use over the temples of spectacles where they go around the ears.

Inquiry No. 9310. Wanted addresses of manufacturers of good selling articles for mail order business catering to the trade of agents.

Inquiry No. 9311. Wanted names and addresses of manufacturers of hatpin heads made of colored glass; also medals of all shapes.

Inquiry No. 9312. Wanted to buy a machine which will pick up a weight the size of a lima bean by vacuum process. Must be able to pick up dust, gravel, etc. Must be operated by electricity and be easily portable.

Inquiry No. 9313. Wanted to buy Leather Held Horse Shoes used temporarily when shoe cannot be nailed on. In other words a Leather Foot with iron shoe at bottom—strapped over horse's foot.

Inquiry No. 9314. This enquirer is in the market for some patented articles which he could purchase and manufacture with an investment of from \$5,000 to \$10,000. The name of the party will be supplied to any of our readers on application.

Inquiry No. 9315. Wanted the name and address of a concern manufacturing novelty ink wells.

Inquiry No. 9316. Wanted the names of manufacturers and manufacturers' agents who make patented articles and other useful devices which appeal to the public and which can be used in a mail order business and by canvassers.

Inquiry No. 9317. Wanted the names and addresses of manufacturers of good selling articles that would appeal to the public where exclusive sale in certain territories can be arranged for; how to sell to the trade and through sub-agents in a house-to-house canvass.

Inquiry No. 9318. Wanted rollers and other appliances for extracting water and moisture from refuse, such as coal dust, with special reference for using it as a fuel.

The Scientific Employment of Men

(Continued from page 69.)

portions. An examination of the portraits of a hundred great generals, pioneers, builders, engineers, explorers, athletes, automobile racers, aeronauts, and others who lead a life of great activity will show a general tendency toward structure on the lines of the square—square face, square body, square hands.

Reference to the portraits of great judges, financiers, organizers, and commercial kings will show a general tendency toward structure upon the lines of the circle—round face, rounded body, and a tendency to roundness in hands and limbs.

Anything which is hard in consistency has comparatively great resistance and persistence. That which is elastic in consistency is adaptable and seems to have spring, life, and energy within it. That which is soft in consistency is pliable and impressionable. These principles have been found to apply to human beings.

Relative development or proportion of the different parts of the head, face, and organs of the body to one another is, in the eye of a physician, the anatomist, and the expert analyst of human character, an indication as to the relative degrees of the three qualities of energy, vitality, and endurance—and of many other characteristics.

Men's emotions, thoughts, and tendencies show themselves in the expression of the face, quality of voice, gestures, walk, clothing, etc. Since the human body is plastic, any emotion, thought, or tendency which has become habitual leaves its permanent mark in all the forms of expression.

"Normally," says Mantegazza, "every thought and emotion takes form in action: A transitory emotion has a fugitive expression which leaves no trace, but when it is repeated several times it leaves on the face and other parts of the body an expression which may reveal to us a page of the man's history."

In a similar way, a man's experiences leave their marks upon him.

The foregoing is a summary, greatly abridged, of the indications of each of the nine elements upon which Dr. Blackford and those using her plan base their judgment of qualities and characteristics.

Far more important however, than any one of the nine elements is their combination in the individual. Every individual has his equipment of all nine, and his personality cannot be understood if the significance of even one of the nine is overlooked.

The importance of this consideration may be made clear by chemical analogy. A student of chemistry may learn all the characteristics of oxygen, carbon, and hydrogen, but he may know nothing of the attributes of their many compounds until he has learned the significance of their combination in different proportions.

Just as all human beings are combinations of the nine elements mentioned, so all carbohydrates are combinations of oxygen, hydrogen, and carbon.

Just as carbon, oxygen, and hydrogen in one compound give us fiery, caustic, and poisonous carbolic acid, and, in different proportions, sweet, healing honey, so the nine elements, combined in certain proportions, may make of one man a degenerate thief and murderer, and of another man a patriotic and philanthropic citizen.

The analogy may be carried even further. Oxygen is a gas lighter than air, colorless, slightly acid in odor and taste. Hydrogen is also a gas very much lighter than air, colorless, odorless, and tasteless. Carbon is a solid, and usually hard, dense, and black.

None of the characteristics of any of these three elements are to be found in butter, molasses, phenacetin, or peppermint. Yet these three, and these three only, are in the substances named. In a similar way, combinations of the nine elements of human character in different proportions yield characteristics not indicated by any one of the nine. For example, a man's honesty, his disposition

(Continued on page 77.)



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The Motor-driven Commercial Vehicle

This department is devoted to the interests of present and prospective owners of motor trucks and delivery wagons. The Editor will endeavor to answer any questions relating to mechanical features, operation and management of commercial motor vehicles.

From the Chauffeur's Point of View

BELIEVING that not enough attention is being paid to the human element in estimating the relative efficiency of the horse and the commercial motor vehicle, a representative of the SCIENTIFIC AMERICAN recently interviewed a number of drivers of a large department store in New York to get the chauffeur's side of the subject. The following questions were asked one of the drivers of an electric delivery wagon:

Q. Did you ever drive a horse?

A. Yes, I drove a horse for 7 years before they put me on this truck when the store opened—it was about 3 years ago.

Q. How do you like the motor truck as compared with the horse?

A. Well, I like it a lot better.

Q. Do the other men like the motor truck as well as the horse?

A. Yes, they all like it.

Q. Well, why do you like it?

A. When I go up a street, I can get off at any old place and do not have to bother about hitching. I know that if I want to stop a minute my wagon's just as safe as it would be in the stable; there is no danger of its running away.

Q. Do you find you can cover more ground?

A. I cover about 40 miles in my route every day. I go up around through Harlem and I cover just about the same as I used to with a couple of horses (sic!), but they could only go out about 5 days a week.

Q. Don't you find you can cover your route quicker?

A. No, I don't believe I cover it much quicker. (We are inclined to doubt the accuracy of this answer, particularly in view of the reply to the next question.)

Q. When you get through at night, can't you get to the stable quicker with your truck?

A. Oh, yes. I had to let the horses take their time. I might be several miles away from the stable and then I would have to let them rest a little and not kill them, but I can just turn the juice into the old truck and get through in 25 minutes or so instead of more than an hour with horses.

Q. How much power do you use on the truck?

A. I figure we use about 5 amperes a mile. There is a "guy" that reads the meter when we go in, and he says the average is about 5 a mile.

Q. Do some drivers get more mileage on the same amount of current?

A. Yes, and there ought to be some prizes for that. We can waste the juice by starting into the full too soon, and then we can save it a lot by coasting if we want to.

The answer to the last question is quite significant. There is no doubt that the driver can save current if it would pay him to do so. Motormen on many street car lines are awarded premiums for economical use of electricity. How much more important, then, it is to adopt such a system on a motor car which draws its supply not from an unlimited store at the central station, but from battery cells of limited capacity.

There is no doubt that a driver who is promoted to the position of chauffeur feels the importance of his advancement and does better work. Instead of a mere stableman he now becomes an "engineer." In fact, we should be inclined to think that it would be advisable where possible to make chauffeurs out of former teamsters rather than to hire chauffeurs who had never handled teams; this, of course, provided the teamster shows any aptitude for operating the motor truck. It has been found that the ex-teamster is

more accustomed to loading and unloading the truck, and willing to do his share, whereas the chauffeur may feel that such work is beneath him.

The Motorcycle Truck for Light Deliveries

THE standard motor truck has failed to make much impression on certain



Motorcycle truck plowing through snow with a 600-pound load.

lines of business, for the reason that the deliveries are light, distances traveled are not great, and the business is hardly big enough to justify the initial outlay for a motor delivery vehicle. But there is another competitor of the horse, designed to meet just such a situation. It is the light weight motorcycle truck. The accompanying photograph shows such a truck manufactured by a motorcycle maker, successfully combating a six-inch snowfall at a speed of 25 miles per hour. The vehicle is three-wheeled, driving through the single rear wheel. This makes it unnecessary to use a differential, reduces weight and does away with certain mechanical weaknesses. The vehicle illustrated is designed to carry 600 pounds in addition to the driver. The machine is started without raising the rear wheel from the ground, as is usually necessary in the standard type of motorcycle. The engine does not have to be cranked, but is started by the simple operation of stepping on a pedal. This enables the driver to stop the engine whenever he leaves the truck to make a delivery, thus saving gasoline, and also conforming to the law in certain localities, without at the same time being put to the inconvenience of cranking up his engine. The advantage of a motorcycle for light deliveries lies not only in the economy of first cost, but also in the fact that it uses very little fuel per mile. For instance, on long hauls, the vehicle illustrated can make from forty to forty-five miles on a gallon of

gasoline. Of course, frequent stops would materially reduce this showing. Thirty-two miles per gallon has been given as a fair average estimate, or including the oil consumption, about 60 cents per day of ten hours, covering seventy-five miles. This would be about \$16 per month for gasoline and oil, which is less than the average cost of boarding a horse per month, while, furthermore, a horse could

it is entirely inclosed to protect it from the injurious effect of coal dust. The elevating gear consists of two strands of detachable link belt, to which 18-inch by 8-inch malleable iron buckets are attached at regular intervals; the whole apparatus is mounted on a steel frame carried by a steel truck, the larger wheels of which are 60 inches in diameter and the smaller wheels 20 inches. The machine complete weighs nearly 5,000 pounds, but two men have no difficulty in moving it over hard, level ground. In some cases the machines are made to be moved by their own power.

In operation, one man is required to look after the loader and to operate it. The clutch lever which controls the movement of the buckets is not visible in the picture, as it is on the other side of the machine. After the driver of the truck has placed his vehicle in position under the chute, both men push coal to the foot of the elevator for a few moments. When the truck is nearly filled, the driver moves it forward in order to fill all parts of the vehicle evenly, and trims the load. Under service conditions, a two-ton truck has been loaded with chestnut or smaller sized anthracite in less than five minutes; egg and stove coal are loaded in from six to eight minutes. A special type of loader (illustrated) loads a two-ton truck with bituminous run of the mine or small anthracite in about two minutes or a five-ton truck in five minutes. As a matter of fact, it has been found that the machine handles bituminous coal, which lies at a steeper angle than does anthracite and therefore slides down in larger quantities, so quickly that it does not pay to have the driver leave his truck; he simply trims the load. The foot of the bucket elevator is movable and the distance from the ground can be changed quickly by means of a crank which operates a worm gear keyed to a shaft which winds or unwinds chains attached to the foot. A friction clutch allows the load to be thrown on after the motor has been started; by means of an extension from the clutch lever, control of the elevating gear is placed in the hands of the driver and it frequently is possible for the driver to operate the machine to load bituminous coal without help. The capacity of the machine is estimated at 60 tons of coal an hour provided a sufficient supply is kept under the foot of the elevator; the power required to operate it is five horsepower.

Field Kitchens of the N. G. N. Y.

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of May 31st, 1913, is an article on a Russian auto field kitchen. Although the Russians are ahead of us with the auto (but would not be if the United States Army officials were within a mile of being up-to-date), I think that the Seventy-first Regiment, N. G. N. Y., was the first to practically use the field kitchen for feeding troops in the field. During the Connecticut maneuvers of 1912, three field kitchens were used, and the Seventy-first Regiment was fed regularly and well, while without an exception the infantry regiments under United States Army methods were without food half the time. (Inquire of the Twelfth, Sixty-ninth, Twenty-third, Forty-seventh, Fourteenth, Seventh, or any of the infantry regiments.) This method of feeding troops is especially to be recommended for volunteer troops, which our country will always have to depend upon. In view of possible disputes with some foreign powers and the failures of the commissary department in the early times of 1860 and in 1898, this may be an important question, viz., feeding raw troops, so that they will be kept in service, not in the hospital.

New York. CLARENCE TRUE



Loading run of the mine bituminous coal on a motor truck.

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The Scientific American Cyclopedia of Formulas

Edited by ALBERT A. HOPKINS. Octavo, 1077 pages, 15,000 Receipts. Cloth, \$5.00; half morocco, \$6.50.

¶ This valuable work is a careful compilation of about 15,000 selected formulas, covering nearly every branch of the useful arts and industries. Never before has such a large collection of valuable formulas, useful to everyone, been offered to the public. Those engaged in any branch of industry will probably find in this volume much that is of practical use in their respective callings. Those in search of salable articles which can be manufactured on a small scale, will find hundreds of most excellent suggestions. It should have a place in every laboratory, factory and home.

Concrete Pottery and Garden Furniture

By RALPH C. DAVISON. 16mo., 196 pages, 140 illustrations. Price, \$1.50.

¶ This book describes in detail in a most practical manner the various methods of casting concrete for ornamental and useful purposes. It tells how to make all kinds of concrete vases, ornamental flower pots, concrete pedestals, concrete benches, concrete fences, etc. Full practical instructions are given for constructing and finishing the different kinds of molds, making the wire forms or frames, selecting and mixing the ingredients, covering the wire frames, modeling the cement mortar into form, and casting and finishing the various objects. With the information given in this book, any handy man or novice can make many useful and ornamental objects in cement for the adornment of the home or garden. The information on color work alone is worth many times the cost of the book.

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(Continued from page 75.)

to loyalty, his industry, his carefulness, his conscientious accuracy, and many other such qualities cannot be determined by an observation of any one of these nine elements alone, but can be unerringly appraised by careful observation and analysis of the proportion in which the nine elements are combined.

It is abundantly clear, from the foregoing, that the character analyst who attempted to judge of the qualifications of any applicant for a position merely because he was of fine texture and blonde complexion, would go as far wrong as a chemist who analyzed a carbohydrate quantitatively for carbon and hydrogen, but neglected to do more than determine the presence of oxygen.

Camphor and olive oil have approximately the same proportion each of carbon and hydrogen, but because of a very slight difference in proportion of oxygen, and in the manner of their combination, one is aromatic, strong to the taste, and poisonous; the other is mild, soothing, and nourishing. So two men may be almost exact counter-parts of each other in texture, size, form, color and consistency, but on account of a difference in proportion, expressions, and experience, one will be a lazy, shiftless, careless, irresponsible burden upon society, and the other a successful financier.

It is well known that certain chemicals unite to form useful substances, and that others unite to form either useless or actually explosive and destructive substances. It is also well known that certain men seem to co-operate and harmonize with one another most efficiently, and that certain other men cannot be associated together without inharmonious more or less violent.

Just as chemical analysis enables the experienced chemist to determine which chemicals he desires to mingle in order to obtain desired results, so the experienced analyst of human character has learned how to associate different types of executives and employees to secure the greatest efficiency.

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That this can be done is demonstrated by the success of employment departments installed by Dr. Blackford, and conducted by those whom she has trained.

The conclusions reached by Dr. Blackford and her assistants are sometimes speedily and strikingly verified.

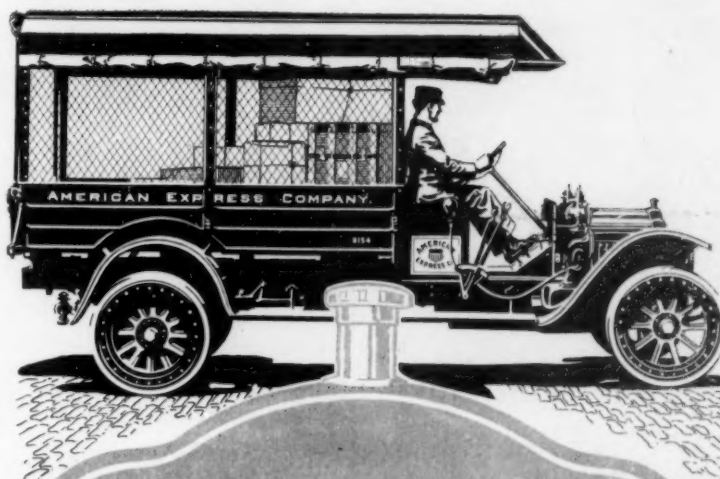
When the employment plan was first installed in a certain factory where many electric cranes were in use, and before there had been time to analyze fully the requirements of all the different classes of work, a requisition was received by the employment department for ten crane operators and twelve crane hookers. The assistant who received the requisition telephoned the superintendent to inquire, something about the work to be done, and the qualifications necessary for its efficient performance.

Among other things, the superintendent said: "This work is rather dangerous, and a careless man might get himself and his fellow workmen seriously injured or killed, so send me men who are very careful."

With this instruction in mind the assistant analyzed a number of applicants, and from them selected fifteen—the fifteen who, with other requirements, were naturally the most cautious and careful.

Not one of the fifteen, when his prospective duties were explained to him by the superintendent, would take the position offered. They were all so cautious that they did not dare attempt such dangerous work!

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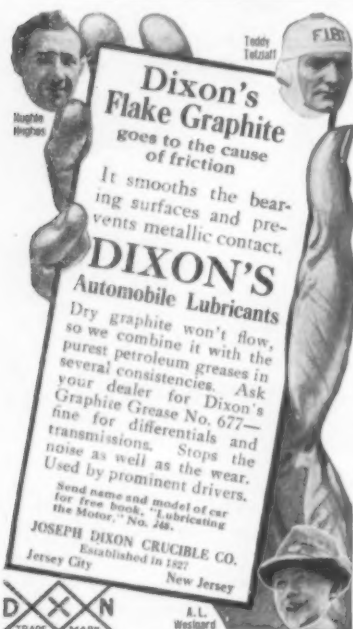
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from the lamp are absorbed by interposing a protecting screen between the light and the film. The protecting screen is described as a celluloid sheet coated with a gelatinous solution.

The Wire Industry

STATISTICS for the wire industry in the United States for 1909 are presented in detail in a bulletin soon to be issued by Director Harris of the Bureau of the Census, Department of Commerce. It was prepared under the supervision of William M. Stewart, chief statistician for manufactures.

The manufacture of wire in the United States is carried on by three classes of establishments: (1) Establishments whose principal business is the drawing of wire from rods which are either purchased or transferred from independently operated rolling mills of the company, thus including the detached and independently operated wire mills of companies rolling the wire rods; (2) establishments that roll iron and steel, copper or other metals or alloys, and maintain wire-drawing departments supplied with rods from the co-operating rolling mills; and (3) establishments whose principal business is the manufacture of some quite different product, but which incidentally draw some wire, usually as material for their own consumption.

There are many establishments which draw no wire, but which manufacture wire goods (fencing, wire cloth, springs, etc.) from purchased wire. Such establishments are not covered by the census statistics for the wire industry.

The total number of establishments in the United States in the wire industry as a whole in 1909 was 93, of which 56 were wire-drawing mills proper which purchased the wire rods used, 31 were wire departments of rolling mills, and 6 were wire departments of other concerns.

The total value of the products of these 93 mills or wire departments was \$180,083,522, of which \$173,349,614 consisted of wire and products derived therefrom. Of this latter amount, 45.7 per cent represented the value of products of the wire mills and 50.8 per cent that of the wire departments of rolling mills.

Data regarding the wire industry as an entirety are not available for 1904 and 1899, but an approximate idea of its growth may be gained from the statistics of the production of wire rods of iron and steel. The output of such wire rods in 1899 was 916,587 long tons; in 1904, 1,792,704 long tons, and in 1909, 2,295,279 long tons, the increase for the decade being 150.4 per cent.

The large plants predominate, especially among the wire departments of rolling mills. The 24 wire departments of rolling mills whose product exceeded \$1,000,000 in value together contributed \$89,407,015, or almost one half of the total of products of the industry.

Of the 93 establishments in the industry in 1909, 59 drew iron and steel wire exclusively, 7 drew copper wire exclusively, 6 drew wire from materials (chiefly brass) other than iron and steel or copper, while 21 drew wire from two or more of the metals. A large proportion of the establishments manufactured wire nails, barbed wire, woven wire, and other products for which plain wire is the principal material.

Of the total expenses reported by wire mills in 1909, salaries represented 2.8 per cent; wages, 13.3 per cent; cost of materials, 78.2 per cent; and miscellaneous expenses, 5.7 per cent.

The cost of materials in 1909 represented 71.7 per cent of the total value of products, and the value added by manufacture, 28.3 per cent.

The total number of persons engaged in wire mills in 1909 (not including the wire departments of rolling mills) was 19,945, of whom 18,084, or 90.7 per cent, were wage earners.

A Rapid Service Life-boat System.—In a patent, No. 1,062,637, Melvin D. Conklin, of New York city, provides for the rapid launching of life-boats by means of a

life-boat track which extends from the deck down alongside the vessel to the water line and is so supported that it may be swung from a position extending transversely out from the vessel to one lying against the side of the vessel.

French Fisheries on the Newfoundland Banks

TWO recent consular reports from St. Pierre call attention to the many interesting and unique features of the French fisheries on the Newfoundland Banks. This industry is more than 400 years old, and has changed but little with the progress of the centuries. The only important innovation was the substitution of light dories for the clumsy "chaloupes" in use prior to 1865. It is true that within the past five years the steam trawler has appeared as a rival, but not yet a dangerous rival, of the brig and schooner.

In 1912, 240 vessels and 6,838 men engaged in the Banks fisheries constituted what is known as the "metropolitan" fleet, i. e., vessels fitted out in Normandy and Brittany. These vessels leave France in late March or early April and require from 14 to 45 days for the passage, according to wind and weather. The voyage is perilous, for the craft are very small and the methods of navigation are of the simplest. The masters of these vessels take observations for latitude, but have no chronometers and cannot determine their longitude with any accuracy. On the outward journey they can tell roughly from soundings when they have arrived at the Banks; returning they can estimate their position when they cross the steamer lanes converging toward the English Channel.

Besides the metropolitan fleet, a certain number of vessels (40 in 1912) are fitted out in the colony of St. Pierre and Miquelon and manned with Normans and Bretons who come out in the spring on a steamer chartered for the purpose and return to France at the end of the season. Formerly these men made the journey in sailing vessels, which were often dangerously crowded. The combined fleet in 1912 numbered 7,500 fishermen.

The fishermen do not work for wages, but for a share in the catch. Before they leave France they receive an advance payment, varying from \$75 to \$150, to be deducted from their future earnings. If, as not infrequently happens, a man's share at the end of the season is not sufficient to cover the amount advanced to him, the owner of the vessel loses the difference, and the man himself comes home with empty pockets. The fisherman's total earnings in seven months of hard labor and exposure probably do not average more than \$150. Strangely enough, the men appear to be content with their lot, and all the reforms that have been effected toward improving their wages and the conditions under which they labor have been initiated by naval officers, administrative officials, enlightened ship-owners, and persons engaged in the Société des Oeuvres de Mer.

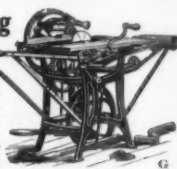
The American Mining Congress

MANUFACTURERS of mining machinery, rescue and first aid apparatus and safety appliances are to be given an opportunity to display their wares before the mining men of the country at a great industrial exposition to be held under the auspices of the American Mining Congress, in Philadelphia, Pa., the week of October 20th.

This exposition, the first of its kind in this country, will be held in conjunction with the annual convention of the Mining Congress and the double attraction is expected to attract thousands of interested men. It will be entirely national in scope, the metal mining interests of the West to be as fully represented as the coal mining of the East. In fact, there is a tentative plan to have a gold mining camp in full operation with a mill crushing the ore. Horticultural Hall, the biggest place of its kind in Philadelphia, situated in the heart of the city, has been engaged for the occasion.

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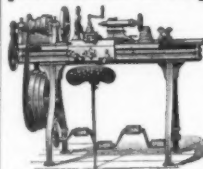
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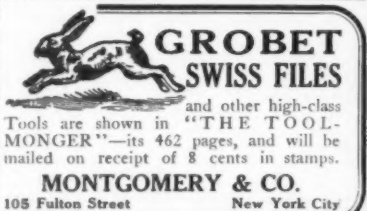
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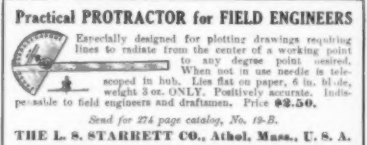
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NEW BOOKS, ETC.

IRON AND STEEL. Their Production and Manufacture. By Christopher Hood. New York: Isaac Pitman & Sons. 8vo.; 150 pp.; illustrated. Price, 75 cents.

RUBBER. Production and Utilization of the Raw Product. By H. P. Stevens, M.A., Ph.D., F.I.C., and Clayton Beadle. New York: Isaac Pitman & Sons. 8vo.; 132 pp.; illustrated. Price 75 cents.

These are two volumes of the handy and useful "Common Commodities of Commerce" series. The first deals with the most important of all commodities—iron. Its story is of necessity told in a broad and general way, owing to exigencies of space; still, a great deal of profitable information is packed within the covers of the little book. "Rubber" reveals the foundation facts relating to the cultivation of the rubber tree, and to the manufacturing processes which shape the raw material into the finished product. The book offers itself merely as a gateway to a wider study of the subject.

A NEW METHOD IN MULTIPLICATION AND DIVISION. By William Timothy Call. Hawthorne, N. J.: C. M. Potterdon, 1913. 16mo.; 67 pp. Price, 50 cents.

"It is not a matter of importance. It is a curiosity." This is the author's own valuation of his discovery. However, Mr. Call has such a humorous and striking way of putting the commonest things that his tiny book may be highly commended for general reading. The new method is not one of reciprocals, of complements, or of factoring, but is a method of conversion.

SUBURBAN GARDENS. By Grace Tabor. New York: Outing Publishing Company, 1913. 12mo.; 207 pp.; illustrated with diagrams.

The author has very decided ideas on lay-out and arrangement, and deprecates the prevailing custom of dealing with a suburban site as if it were a country estate in miniature. Her book is a sensible setting-forth of sound principles, combined with a wealth of suggestion that should be extremely helpful.

MECHANICAL DRAFTING. By H. W. Miller, M.E. Peoria, Ill.: The Manual Arts Press, 1912. 12mo.; 219 pp.; 222 figures. Price, \$1.50.

DESCRIPTIVE GEOMETRY. By H. W. Miller, M.E. Peoria, Ill.: The Manual Arts Press, 1911. 12mo.; 148 pp.; with figures. Price, \$1.50.

"Mechanical Drafting" presents a flexible course designed to develop to the full the energy and intellect of the student. The text is marked by the absence of purely abstract geometrical problems. It dispenses with the necessity of lecturing, and continually seeks to couple drafting with shop operations. "Descriptive Geometry" is framed to be within the intellectual scope of the high-school graduate. It presents a complete treatment of point, line, plane, intersections and developments, shades and shadows, and linear perspective.

LABORATORY GUIDE TO PARASITOLOGY. By W. B. Herms. New York: The Macmillan Company, 1913. 8vo.; 72 pp. Price, 80 cents.

The author, seeking to place parasitology on a par with other phases of applied biology, has here given us a series of exercises and discussions based upon the University of California courses.

PRINCIPLES OF IRRIGATION ENGINEERING. Arid Lands, Water Supply, Storage Works, Dams, Canals, Water Rights and Products. By Frederick Haynes Newell, Director U. S. Reclamation Service, and Daniel William Murphy, A.B., A.M., Ph.D., Engineer in charge of drainage, U. S. Reclamation Service. New York: McGraw-Hill Book Company, 1913. 8vo.; 293 pp.; illustrated. Price, \$3 net.

The work is a broad presentation of the important problems confronting the irrigation engineer. Written primarily for students and engineers, an attempt has been made to so frame the text as to allow of its being intelligible to readers who lack a thorough knowledge of hydraulics. The writers' definition of irrigation engineering is "the development of the water resources of arid regions as relating to their conservation and use as a part of the wealth of the nation." Attractive photographs of the most interesting projects are reproduced as illustrative plates, and the whole work must be commended as authoritative. It makes highly profitable reading.

THE MODERN WARSHIP. By Edward L. Attwood, M. Inst. N.A., Royal Corps of Naval Constructors. New York: G. P. Putnam's Sons, 1913. 12mo.; 145 pp.; illustrated. Price, 40 cents net.

"The Modern Warship" is an excellent little book written from the naval architect's viewpoint for the general reader. It gives the man in the street an admirably clear insight into the intricacies of warship design and construction from initial calculation to the test run. The hull, armor, propelling machinery, fuel, equipment, and armament all come in for adequate consideration and discussion. The amount of information conveyed is creditably disproportionate to the size of the work.

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A new quality of luxury

A new element of efficiency

A new source of economy

Each year you have looked to the Cadillac for the real and substantial progress in motor car development.

You have looked to the Cadillac for the great essentials in the practical motor car.

And you have not looked in vain.

Now conceive, if you can, a Cadillac with its essential functions sharpened, accentuated and refined.

Conceive such a process of refinement culminating in an entirely new riding quality of unexampled ease.

That is precisely what has come to pass in this new car.

The principal contributing factor—the two speed direct drive axle—is described in detail elsewhere.

The Cadillac Delco electrical system of automatic cranking, lighting and ignition, the first practical system ever made and first introduced by us, has, after experience with it on 27,000 Cadillacs, been still further

developed, improved and simplified and the slight attention required from the user materially reduced.

The carburetor has been improved, its efficiency and its well-known economy increased. It is hot water jacketed and electrically heated to facilitate starting in cold weather.

The rear springs are six inches longer.

The body designs are new and strikingly handsome.

Front seat passengers may enter or leave the car at either side.

These and many other refinements of essential details make for a greater and a better Cadillac and serve to more firmly establish its position as America's leading motor car.

The Cadillac Company has never disappointed you in the smallest particular or in a single promise.

We promise you again, in this new car, a positive revelation in motor car luxury.

Cadillac two-speed direct drive axle

The advantages of this axle do not lie in its being an improvement so far as its functions as an axle are concerned, but rather in the manifold advantages attained in other directions through the medium of the axle.

In the place of the single bevel pinion and single bevel driving gear common to ordinary construction, there are two bevel pinions and two bevel driving gears. This affords two different gear ratios, each driving direct from the engine to the axle without intermediate gearing.

The usual single direct drive gear ratios range from about 3.5 to 1 down to 4 to 1 according to the car. Any single gear ratio is necessarily what it is because a single gear ratio must be, or should be, the particular one which is best adapted for all around general use.

No one single gear ratio can possibly be just right for all speeds and for all conditions. But by using two direct gear ratios we have exactly doubled the means for promoting the economical and efficient application of power developed by the engine to the driving of the car.

In the new Cadillac axle we have, as before stated, two direct drive gear ratios. The low direct drive gear, which is 3.66 to 1, is especially adapted for city driving, where starting, stopping and slowing down are frequent and where cautious operation is necessary.

The high direct drive gear ratio, which is 2.5 to 1, is of special advantage where speeds of about 16 miles or more per hour are permissible and desirable. The change from one gear ratio to the other is made by means of a simple, convenient electric switch.

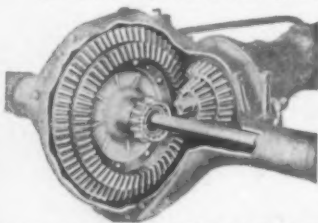
The advantages of the high direct drive gear ratio lie primarily in the fact that with it, any given speed of the engine produces an increase of about 42 per cent in the speed of the car. For example: at an engine speed of 700 revolutions per minute, with the low direct gear engaged, the car will travel approximately 21 miles per hour; while on the high direct gear it will travel approximately 30 miles per hour with no increase in engine speed.

This great increase in car speed in its relation to engine speed accomplishes a number of desirable things.

Among these is a decrease in gasoline consumption for a given mileage. This is due to the fact that with the engine turning over slowly—comparatively speaking—a given quantity of gas is utilized to greater advantage and generates more actual power than with the engine turning over more rapidly. Friction also is materially reduced by reason of the parts operating more slowly and this, too, is a factor in reducing gasoline consumption when driving on the high gear.

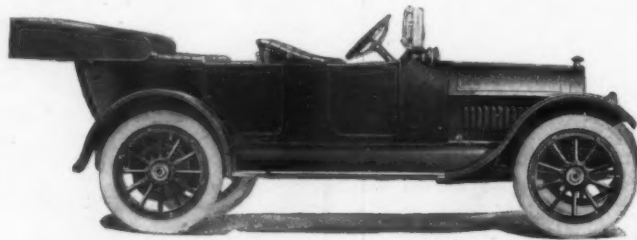
Another great advantage is that with this direct drive high gear ratio, there is obtained an extraordinarily luxurious smoothness in running, together with a marked quietness and a comparative freedom from the vibration which, to a greater or less extent, is ever present when traveling at high speed with a low gear ratio.

In attaining these much desired qualities, instead of adding complications to the power plant which make for greater fuel consumption and for greater upkeep expense, they have been attained by methods which are strikingly the reverse, viz., by methods which lessen the fuel consumption, methods which decrease friction with its resulting wear and methods which make for longer life, together with an appreciable decrease in the cost of operation and maintenance.



Specifications in brief

ENGINE—Four-cylinder, 4½ inch bore by 5½ inch stroke; silent chain-driven cam shaft, pump shaft and generator shaft; enclosed valve mechanism. Five-bearing crankshaft. HORSE-POWER—40-50. COOLING—Water, copper jacketed cylinders. Centrifugal pump; radiator, tubular and plate type. IGNITION—Delco dual system. CRANKING DEVICE—Delco Electrical, patented. LUBRICATION—Cadillac automatic splash system, oil uniformly distributed. CARBURETOR—Special Cadillac design of maximum efficiency, hot water jacketed and electrically heated; air controlled from driver's seat. CLUTCH—Cone type, large, leather faced with special spring ring in fly wheel. TRANSMISSION—Sliding gear, selective type, three speeds forward and reverse. special alloy steel live axle shafts; two speed direct drive (see detailed description). Front axle, drop forged I beam section with drop forged yokes, spring perches, tie rod ends and roller bearing steering spindles. Front wheels fitted with Timken bearings. BRAKES—One internal and one external direct on wheels, 17 inch by 2½ drums. Exceptionally easy in operation, both equipped with equalizers. STEERING GEAR—Cadillac patented worm and worm gear sector type, adjustable. 18 inch steering wheel with walnut rim; aluminum spider. WHEEL BASE—120 inches. TIRES—36 inch by 4½ inch; Q. D. demountable rims. SPRINGS—Front, semi-elliptical. Rear, three-quarter platform. FINISH—Calumet Green with gold stripe. STANDARD EQUIPMENT—Cadillac top, windshield, full lamp equipment, gasoline gauge, electric horn, power tire pump, foot rail and cocoa mat in tonneau of open cars, robe rail, tire holders, set of tools, tire repair kit, Warner Autometer.



Five passenger Touring Car \$1975

Seven passenger car	\$2075	Landulet Coupe, three passenger	\$2500
Phaeton, four passenger	1975	Inside drive Limousine, five passenger	2800
Roadster, two passenger	1975	Standard Limousine, seven passenger	3250

All prices are F. O. B. Detroit and include standard equipment

Cadillac Motor Car Co. Detroit, Mich.